Editorial

WHENEVER a spectacular tragedy takes place during the testing of some new device, or the development of a dangerous matter, we hear doubts expressed as to whether such deaths are justified—whether we were meant to know too much, and so on. I often wonder what those who have lost their lives in this way would say to such opinions if they were here to say it.

Recently a high speed aircraft crashed during a display in England. One of the latest and fastest planes disintegrated in the air after a swifter-than-sound dive over a large crowd of people.

What caused the aircraft to break up isn't clear. The fact that it broke up during the display was unfortunate in that many people were unwilling witnesses, and some were killed by the debris. To maintain that airmen should forthwith stop trying to fly at high speeds might be an understandable reaction emotionally, but it certainly is not a rational one.

These things are relative. To high speed test pilots, and the designers of high speed aircraft, 700 miles is no longer fast, nor highly dangerous. It would not have been so unless earlier aviators hadn't lost their lives demonstrating that extra strains and problems had to be met and solved before we could go through the sound barrier. And these men who died wouldn't have been able to approach the speed of sound unless pioneers before them had taken the risks necessary to establish flight as a reality and not a dream.

Today's designers are thinking in terms of aircraft to fly more than 1000 mph—much more. They couldn't even have started their work without the knowledge contributed by the men who first flew faster than sound. Its certain that others will have to take risks before these super planes actually fly. To abandon work because it grows dangerous is a negation of life itself. By all means eliminate all avoidabe hazards, but having done this, we must be prepared to accept the challenge of the unknown.

To risk one's life in search of new knowledge and new horizons isn't new. The world's history is the story of scientists, chemists, engineers and doctors who have come up against the unknown factor which had to be tested. One of the most tragic cases was of the gallant Madame Curie, who suffered the tortures of radium burns through her early exposure to its deadly rays. But millions all over the world have had reason to think of her with gratitude, when their own suffering had been relieved, and their own lives made safer by the results of research based on her discoveries.

We honor those who have died in battle so that our happiness and lives might benefit. Is there any less reason why we should honor those who have done battle for us in other fields of human endeavor which have the same ends?

When they are gone, their work lives after them. It is our task to build it into the future so that their courage has not been in vain.

John Moyle

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RADIO AND HOBBIES IN AUSTRALIA

A NATIONAL MAGAZINE OF RADIO, HOBBIES AND POPULAR SCIENCE

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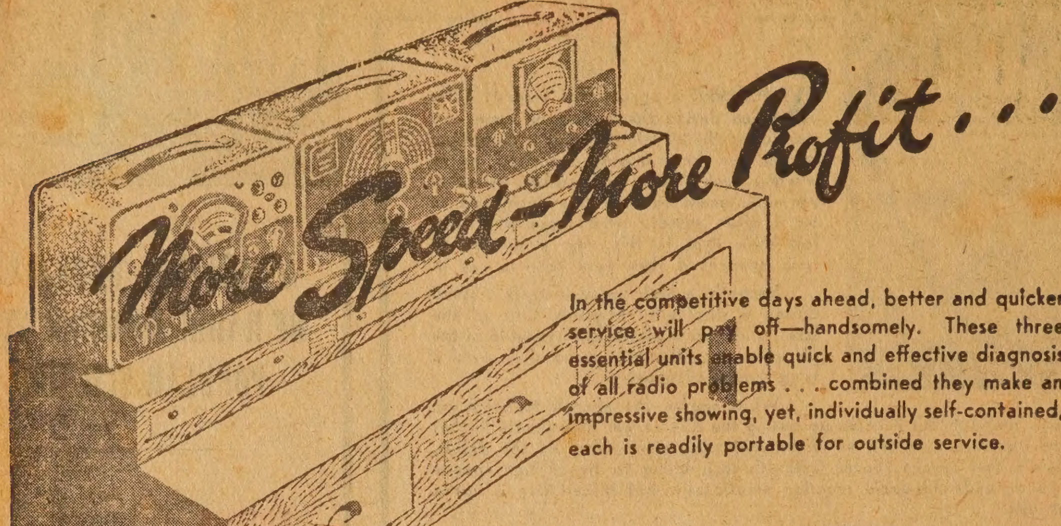
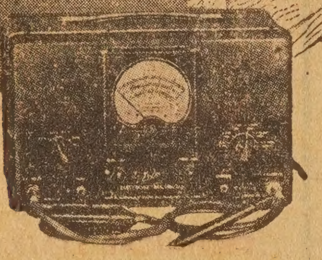
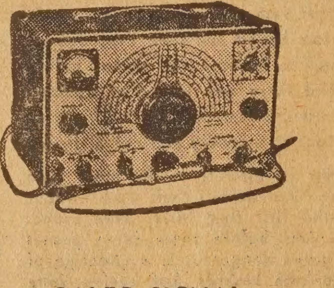
OUR COVER PICTURE

Preparing the mould for the mirror of a new telescope being built in Scotland, which uses the Schmidt optical system. This was first publicised for its possible use in television projection systems, is now being widely applied in other fields. (See story on following pages).



In the competitive days ahead, better and quicker service will pay off—handsomely. These three essential units enable quick and effective diagnosis of all radio problems . . . combined they make an impressive showing, yet, individually self-contained, each is readily portable for outside service.





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Leakage: Less than 0.5. microvolt at 30 Mc/s., decreasing at lower frequencies Triple shielding incorporated.

Attenuator: Ladder type of unique construction with 10 ohm nominal impedance on all but the highest output ranges. Attenuator has negligible effect on carrier frequency

Valves: 2-6SN7; 1-1852; 1-6X5 Dimensions of case: 14 ins. x 8¾ ins. x 8½ ins. Weight: 29lbs. Available for 220-260 volt A.C. and external vibrator operation.

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Housed in our standard size steel case to match other instruments in the Palec range for a neat bench display. Also portable for outside work.
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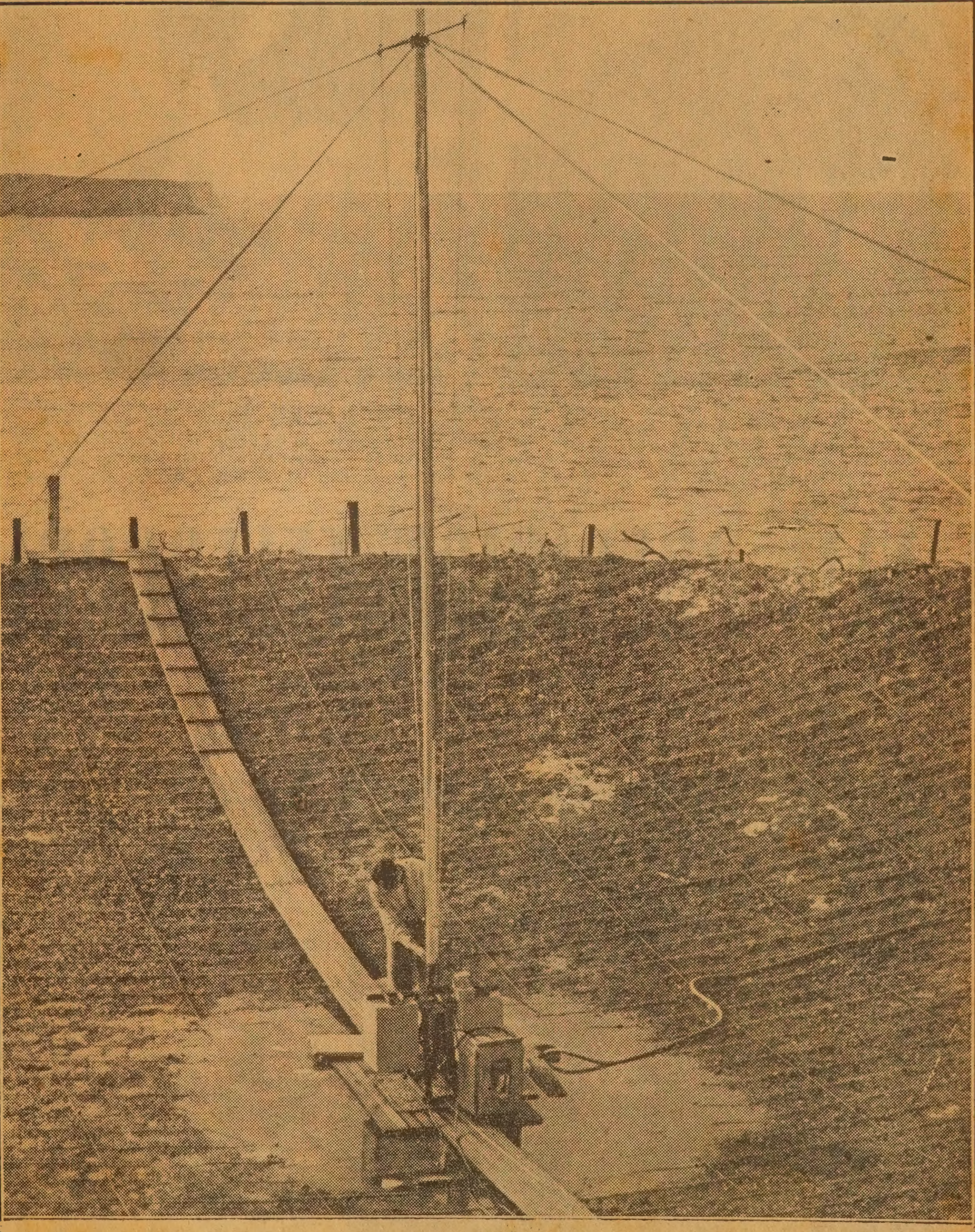
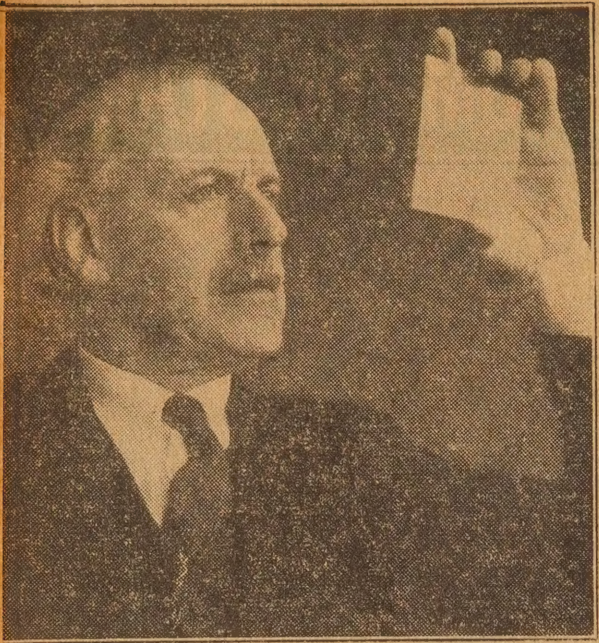
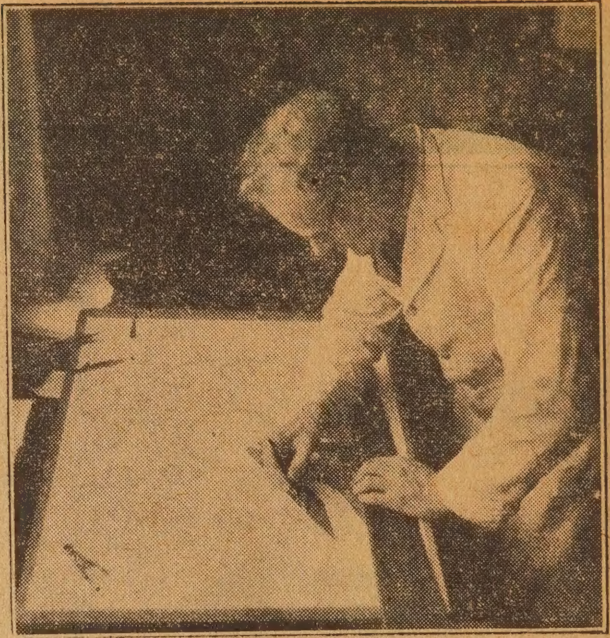
"RADIO SIGNALS" FROM THE STARS



SEEKING to obtain the maximum signal energy from point sources in space, Australian scientists constructed this radio telescope by laying a conducting mesh in a concave excavation. The aerial proper is near the focal point atop the mast. The telescope scans the sky as the earth rotates. Large "steerable" radio telescopes are under construction in various parts of the world.



Dr. E. Finlay Freundlich, the first Napier Professor of Astronomy at St. Andrew's University, examines a photographic plate which has reproduced an accurate record of the "worlds beyond." He is supervising the construction of the 38in Schmidt-Cassegrain telescope now being built.



Robert Waland of Dumfries made telescopes as a hobby until he met Dr. Freundlich. Now his name enjoys world-wide fame, in astronomical circles, as the builder of the first Schmidt-Cassegrain telescope in the world. He is seen examining the layout of the flotation system of the primary mirror in the telescope.

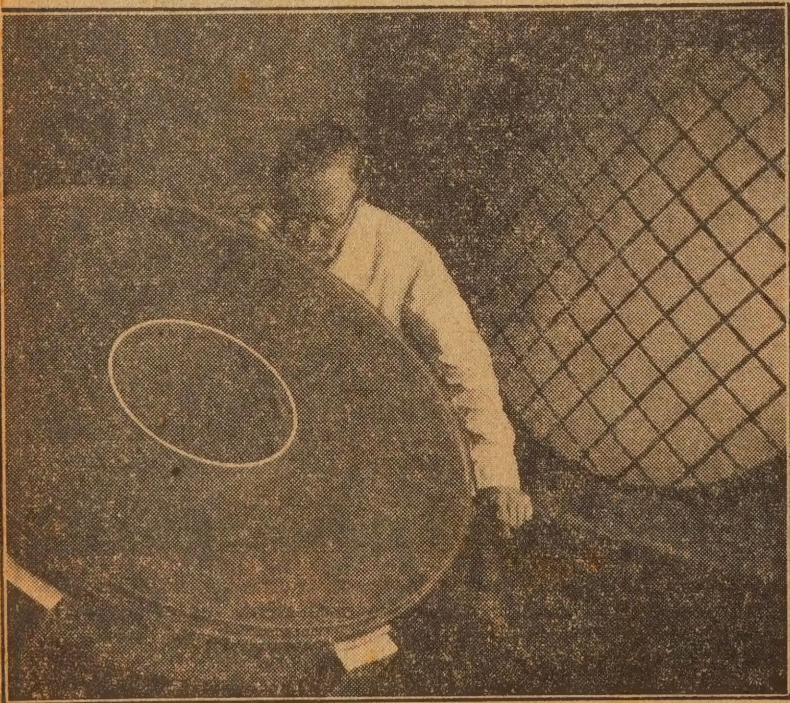
A NEW PRECISION TELESCOPE

A vital advance has been made in the history of the astronomical telescope with the building of a unique type at St. Andrew's University, Scotland. Known technically as the Schmidt-Cassegrain, the new telescope is a powerful instrument in the hands of astronomers.

WITHOUT the drawbacks, time-waste and discomforts involved in photographing sections of the firmament, even with the aid of the largest telescopes, the St. Andrew's instrument combines manoeuvrability with accuracy and clarity.

It has made possible the photography of large areas of the night sky with the maximum of accuracy over the entire photographic plate. As a result, it has aroused the interest of astronomers and engineers all over the world.

For centuries, the Newtonian type of telescope, with all its faults, has had no serious rival. One of its



The grinding of a 38in spherical mirror takes months of hard work and concentration on the part of the scientists and operatives producing it. The plate glass for the new Schmidt-Cassegrain reflector was supplied to St. Andrew's University by the Royal Society of Edinburgh through the Robert Cormack Bequest. Mr. Waland is examining the surface of the reflector-to-be at the end of the grinding. The blank crossword puzzle circle in the background is the head of the machine that did the grinding. It consists of bathroom tiles fixed to a spherical head of steel.

great drawbacks is that the observer has to sit high up in the telescope tube near its upper end. A most inconvenient position.

This is so even at Mount Palomar in America where the 200in Newtonian reflector—the largest in the world—is used.

In 1932, B. Schmidt revolutionised telescope design by adding a correcting plate through which the incident light passes before reaching the mirror. This resulted in the production of well-defined images over a wide field instead of only at the centre as the case was previously.

by H. P. Bellanti

(from London)

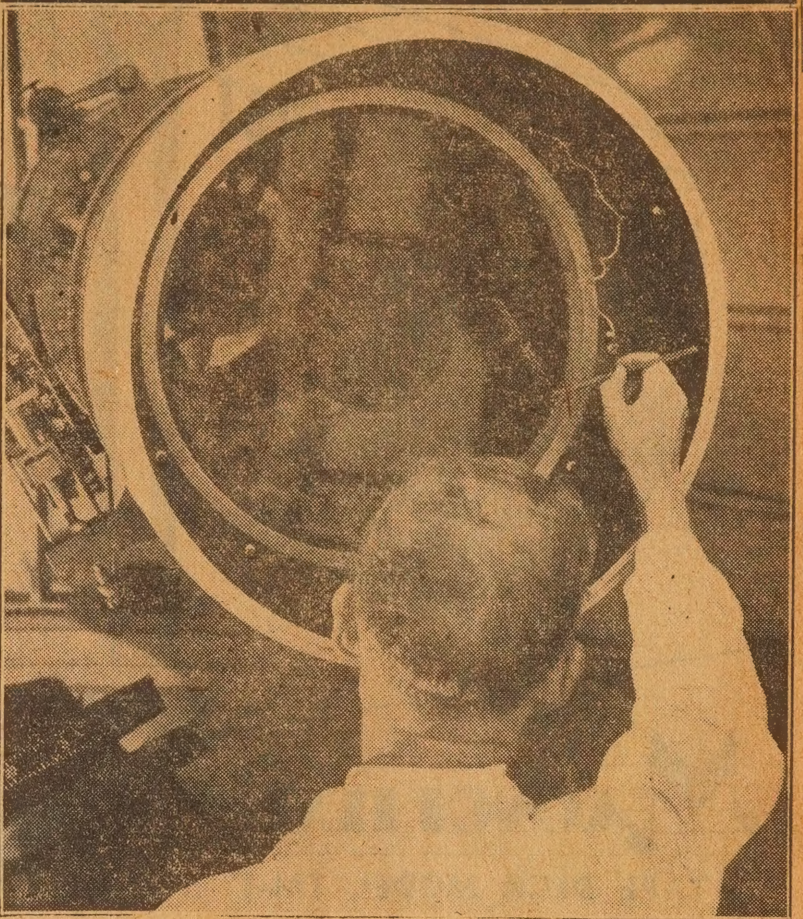
There were still two serious disadvantages in the Schmidt telescope: as the image lay on a spherical surface it demanded the use of a specially-curved photographic plate, and the position of the plate had to be inside the telescope, making it inaccessible for visual observation.

The St. Andrew's project was undertaken with the idea of overcoming these inconveniences. It has succeeded. Indeed, so encouraging have been the results from the pilot-telescope which was completed in 1949, that a 38in telescope on the same principle is now well on the way to completion.

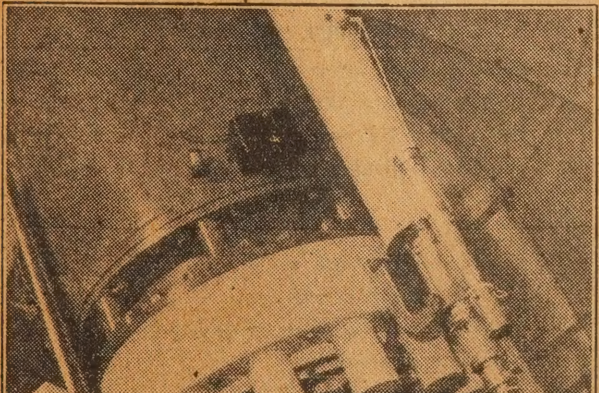
All the work that such a project involves has been and is continuing to be done at the Observatory of St.

(Continued on Page 19)

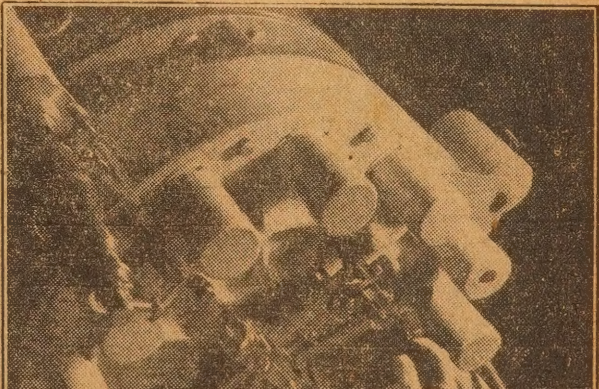
"BUSINESS END" OF TELESCOPE



At the top end of the telescope is the Schmidt plate. It prevents distortion. Mr. Waland made this in his laboratory. He looks after it daily and keeps the smallest speck of dust off it with a delicate camel-hair brush.



To observe parts of the firmament, obserfers lie prone on an adjustable couch. Miss B. M. Middlehurst, M.A. (Cantab.) one of the official observers, is raising herself to the correct position for an hour's observation. Her left hand on the wheel (foreground) controls the couch.



Robert Waland rightly considers the telescope his baby. He, too, observes and takes pictures of the night sky. He is seen here, in the prone position, charging the telescope with a photographic plate. The exposure may be anything from one to three hours.

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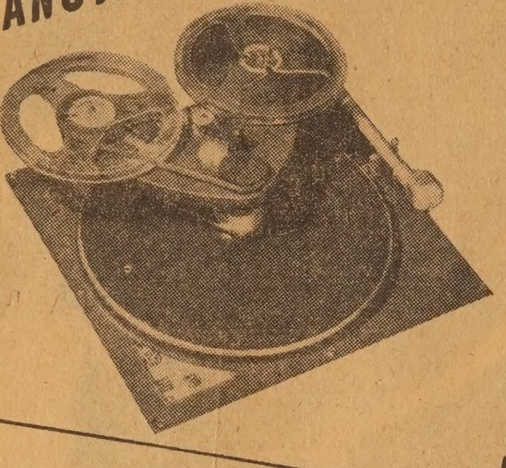

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"SYNTHETIC FUTURE" FOR MANKIND

Man's scientific future is foreseen as bringing clothing made from coal and oil, cures for any human ills and people "kittenish" at 100. This is the view of leading organic chemist, Dr. Roger Adams of the University of Illinois.

DR. ADAMS predicts:

- People happy, healthy and kittenish at the age of 100.
- Clothing made from coal and oil.
- Cure of any human ailment by a variety of drugs and medicinals.
- Storage of the sun's energy for man's use.
- Fish ranches in fenced-off water, rivalling cattle ranches.
- Deliberate moulding of people, mentally and physically, by drugs.
- Pears, apples, and oranges the size of grapefruit.
- And even inter-planetary football matches and celestially-anchored hot-dog stands along rocket ship routes.

Dr. Adams, principal speaker and retiring president of the American Association for the Advancement of Science meeting, projected at that organisation's annual meeting in Philadelphia the chemical discoveries of the past to logical achievements in the future.

PRESENT PROPORTIONS

Pointing out that a century ago all materials used by man were derived directly from the natural sources of plants, animals and minerals, he explained that the chemist can now determine the atomic patterns in nature's substances and assemble atoms to his own design. Man creates new, better and cheaper compounds.

Already dyes are 99 pc synthetic, drugs and medicinals are 75 pc synethetic and natural gums and resins account for only 5 pc of the 2.53-billion pounds of plastics produced last year in the United States.

Half the paint, half the rubber and a fifth of the textiles are synthetic. A billion pounds of synthetic detergents are produced annually, although more soap than that is still consumed.

Titanium is the metal of the future, in Dr. Adams opinion, since it is the fourth in abundance of all metals and its ores are widespread. It is only half as heavy as steel, ductile in pure form, valuable in alloys, heat and chemical resistant, even to sea water and in jet engines.

High price due to difficulty in separating it from its ores is the problem, and Dr. Adams predicts than a cheaper way will be found and it will come into wide use.

Mineral deposits of ores of less common metals, such as copper, lead, zinc, manganese, chromium, tungsten and tin will be found cheaper in the earth and under lakes and seas, he forecast.

The sea, from which magnesium, bromine and salt are now extracted commercially, will be mined in the future for other elements.

Exhaustion of the supplies of oil, natural gas and coal in the earth's crust has been predicted periodically for three decades, but Dr. Adams observed that still new reserves continue to be discovered, though with greater difficulty and at increased expense.

He prophesied that when the time of exhaustion finally arrives, scientists will have found substitutes or this kind of fuel will no longer be needed.

Industry has now turned to petroleum for a substantial portion of its chemicals for the synthesis of dyes, drugs, plastics and synthetic fibres. Just a decade or two ago these were made largely from coal tar, the volatile liquids obtained when coal is coked.

Future power for the world will come from the use of solar energy, in Dr. Adams' opinion. The energy that reaches earth from the sun is more than 30,000 times that of all the fuel and water now used.

Algae-growth in water which can quintuple the yield of the best land growth may be one successful method of collecting the sun's energy. Replacement of the green chlorophyll of the plant by synthetic dyes and inorganic chemicals in the method of artificial photosynthesis appears promising.

Energy absorption by glass shows promise of surpassing the best agricultural capture of sun energy. And phosphorus might be employed absorb energy from the sun duri the day and for illuminating pu poses at night, Dr. Adams suggeste

An extraordinary development synthetic polymers, the chemica that are giant molecules manufa tured from very simple molecul was predicted, added to the amazi plastics and fibres now commercial available or about to come out laboratories.

NEW RAYON

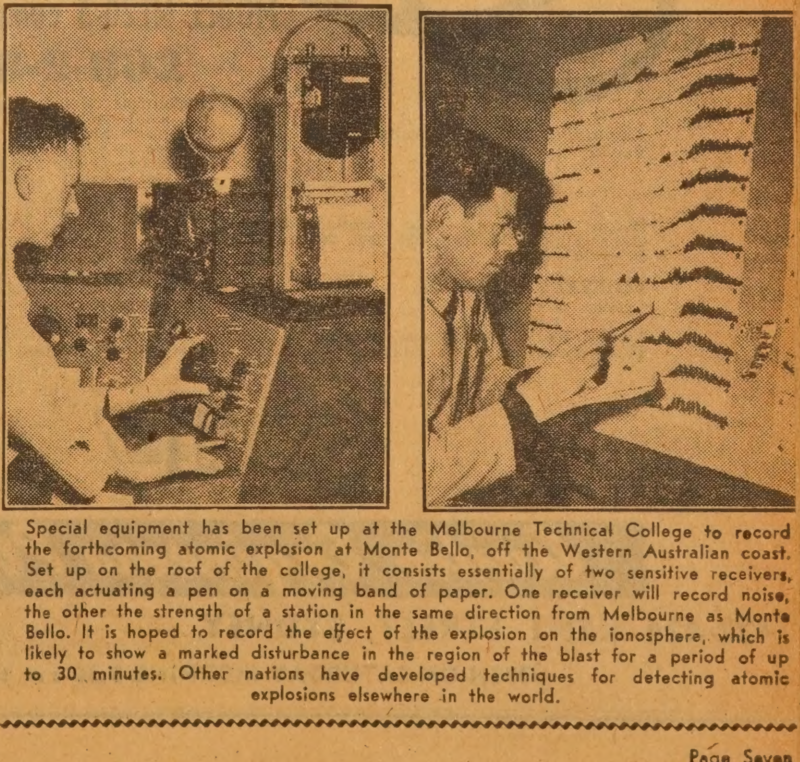
The future will see, according Dr. Adams, transparent plastics th will not gradually discolor and t surface of which will not scrat or craze, finishes for wood and meta which will remain durable for lo periods of time in the presence sunlight and salt air, transpare flexible, waterproof and moistur proof film which will be as stro as desired.

A rayon will come on the mark with a basic structure so modifi that it has strength when wet equ to that of natural fibres.

The chemists will not be able find a synthetic fibre that will d rapidly like nylon and at the san time allow moisture to penetra it like cotton, Dr. Adams explaine

(Continued on Page 23)

WILL RECORD ATOM BOMB EXPLOSION



Special equipment has been set up at the Melbourne Technical College to record the forthcoming atomic explosion at Monte Bello, off the Western Australian coast. Set up on the roof of the college, it consists essentially of two sensitive receivers, each actuating a pen on a moving band of paper. One receiver will record noise, the other the strength of a station in the same direction from Melbourne as Monte Bello. It is hoped to record the effect of the explosion on the ionosphere, which is likely to show a marked disturbance in the region of the blast for a period of up to 30 minutes. Other nations have developed techniques for detecting atomic explosions elsewhere in the world.

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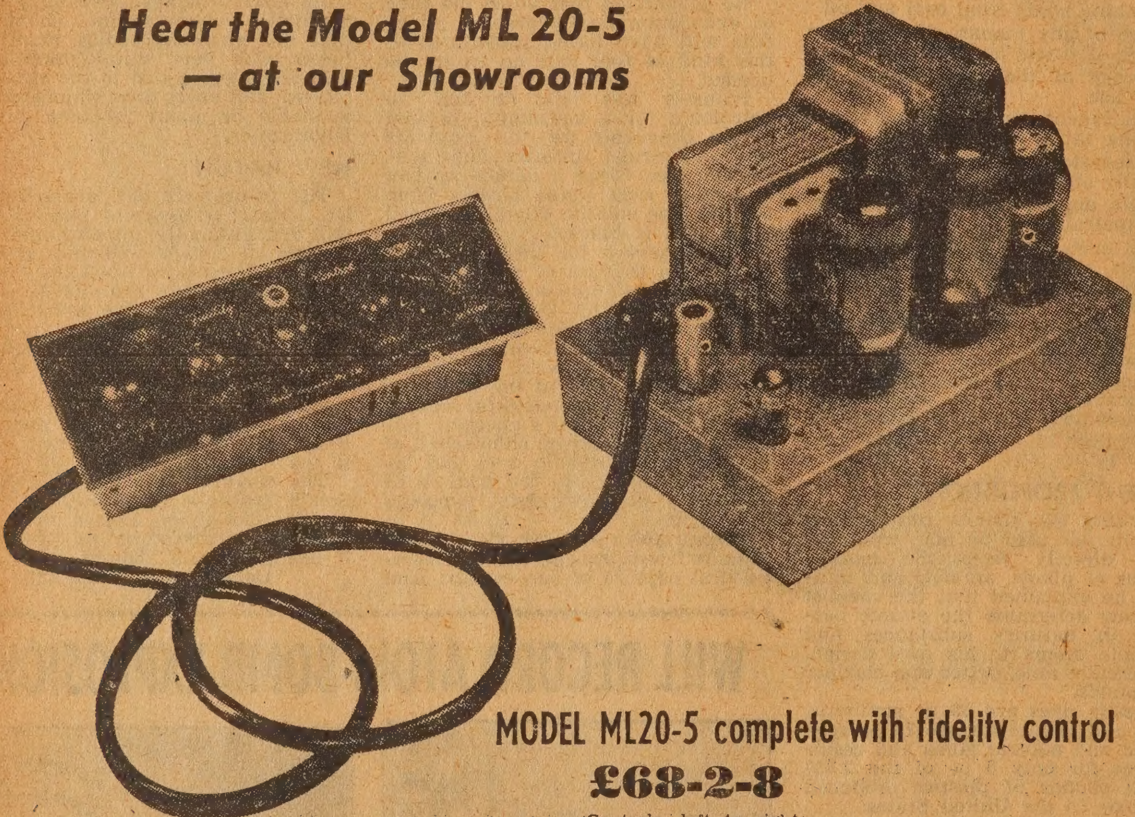

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- No. 3—Bass control, rise and fall.
- No. 4—Treble control, rise and fall.
- No. 5—Input selector, 5 position.
  - Position 1: Radio.
  - Position 2: LP records.
  - Position 3: 78 American records.
  - Position 4: 78 European records.
  - Position 5: Microphone.

Input voltage for pickup—20 millivolts.
General: Compensation for record characteristics built into control unit, independent control of bass and treble. Sharp cut off filter for minimising scratch on old records without affecting operation of bass and treble controls.

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150 YEARS OF FRENCH SCIENCE

An official ceremony presided over by M. Andre Marie, Minister for National Education, was held recently in Paris in the Great Amphitheatre of the Conservatoire National des Arts et Metiers (National Museum and School of Arts and Crafts). The occasion was its hundred and fiftieth anniversary.

☆

One of many exhibits shown to the public at the 150th anniversary of French National Museum and School of Arts and Crafts. Shown here is the first loom built by Jacquard.

by

R. Audibert

From Paris

THE president of the Republic honored the event with his presence, for the nation was paying tribute that day in a twofold celebration: that of human invention applied to technical progress and the status the French National School has given to individuals who show intelligence and determination in their studies.

The speakers paid tribute to the most amazing technical museum in the world, containing Pascal's arithmetic machine, the one by Denis Papin, the standard metre and kilogram of 1793 that founded the metric system, Jacquard's loom, the Jefferson of ploughshare farming genius, and President of the United States, the instruments of Daguerre, Marey and Lumiere, Gramme's first dynamos and Branly's coherer.

These classic wonders, and many more recent ones, are exhibited beneath the Gothic arches of a chapel which the great French Revolution dedicated to scientific discovery.

GREAT NAMES

Many illustrious names were impressively recalled during the ceremonies, back to that heir to the lights of the 18th century, Abbe Gregoire. The abbe started his report on the establishment of the Conservatoire with this modest prophecy, "Doing with one man, with the help of machines, what without them would be done by two or three men."

Thus, in terms of contrasts, old and new, there lived again the spirit and works of all who, in a hundred and fifty years, have established the Conservatoire des Arts et Metiers, as a Museum of Techniques, and a Centre of Applied Research. Above all, it is the National Centre entrusted with standards measurements and the development of new methods.

But the Institution had its human side, too, expressed in its Ancient Article II. "The construction and use of tools and machines useful in arts and crafts will be explained." The teaching mission of the establishment arose from this text.

A free school of spinning in 1804 and a school of drawing applied to the mechanical arts in 1806, marked the beginning of a practical form of technical education intended for workmen and for young people without adequate means.

In 1819, three chairs, held by Charles Dupin the physician, Clement Desormes the industrial chemist and J.B. Say the economist, grouped for the first time audiences of men, young and old, who worked on manual tasks in the daytime, and came in the evening to get the "light of science" on their crafts from their masters.

From then on, the social purpose of the Conservatoire was clear.

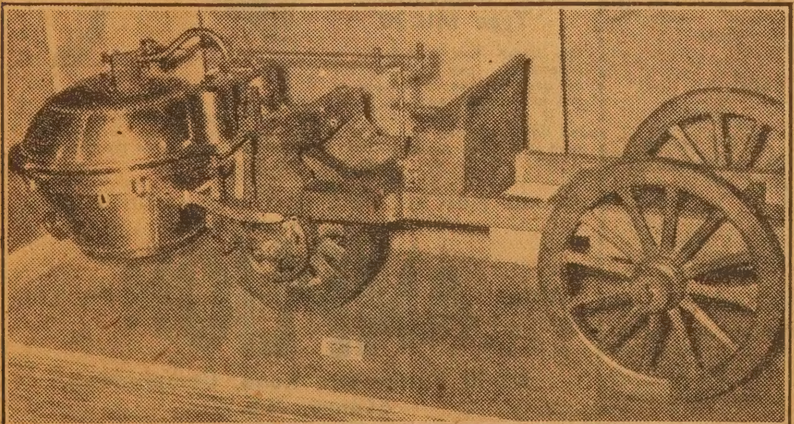
Every evening from November to June, young people over eighteen and workers and technicians up to fifty years of age, bustle through the doors in Rue Saint Martin.

MANY SUBJECTS

A choice of forty-seven different courses ranging from mathematics and commercial law to the most amazing specialised branches of chemistry, electronics and finance are set before this mixed public in accordance with this one maxim: "Teaching free of charge given after normal working hours to all whom the hazards of life have deprived of early education."

On Saturdays and Sundays, eleven hundred of these lecture-goers without diplomas do practical work in the various branches. Those most receptive to study can make a real effort and aspire to a certificate. 5000 attendance cards were stamped in 1939. Today there are 24,000.

That is why the professor of electricity is obliged to repeat his lecture three times in the amphitheatre where Paul Painleve once taught their anonymous predecessors. At the same time at a higher level, the best students of the year do research with masters who selected them from the rest and can obtain a very high engineering degree.



Another famous exhibit in the French National Museum—a model of a twin cylinder steam-driven car.

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ACOS G.P. 20

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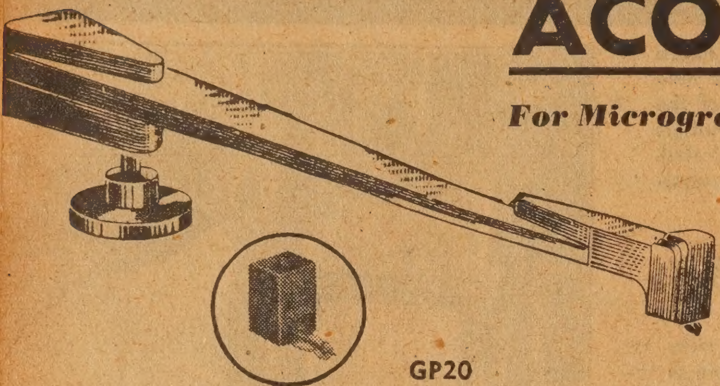

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GP9 Cartridge to fit GP10 Pickup .. Price **31/6**

GP20

The GP20 pick-up is designed for use with the standard 78 rpm records for the 33 1-3 or 45.rpm long playing microgroove records. To meet these differing requirements, two interchangeable slide-on heads are available.

GP19 head supplied as standard.

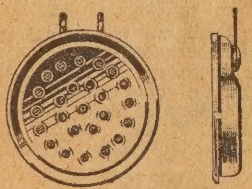
GP19 L.P. head available for microgroove. It is something new in pick-up design and has 20 times greater output than comparable magnetic types, while needle talk and motor rumble are practically non-existent— permanent sapphire stylus—wide frequency response.

PRICE .. GP20, complete with standard head £5/6/0

Price .. GP 19 LP head £2/19/9

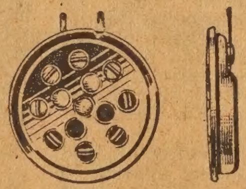
PRICE .. GP19 standard head.. .. .. .. £2/19/9

ACOS MICROPHONES and MIKE INSERTS



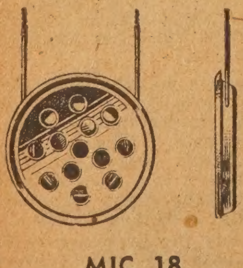
MIC 3

MIC3 Diaphragm-actuated Crystal microphone specially designed for the reproduction of speech frequencies. With rising response from 1000 c/s, this microphone has exceptional sensitivity.
PRICE, 39/3.



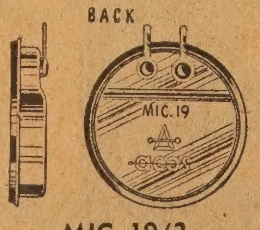
MIC 14

MIC14 Standard Speech Microphone itself with nickel-plate brass case which gives high corosion resistance, mechanical strength and rigidity.
PRICE, 39/3.



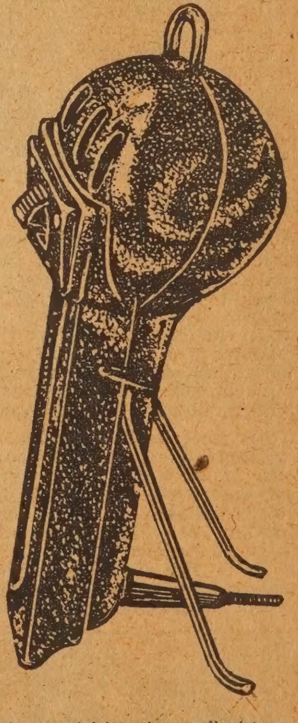
MIC 18

MIC18 Microphone Speech insert provides high acoustic qualities with minimum bulk. Where exceptional slimness is required this insert is recommended. .. ..
PRICE, 39/6.



MIC 19/2

MIC19/2 Sintercel fulfils the requirement for a flat insert with good sensitivity and a frequency response 40/8000 c/s. Unaffected by vibration, exceptionally robust construction.
PRICE, £2/19/9.



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Public Address: High output, light, yet rugged, may be adapted as a lapel mike.

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Deaf Aids: Used by all leading Deaf-Aid Manufacturers.

Combination Hand-Desk Microphone. Type MIC30

This latest Acos release is a superlative new Microphone designed for use as a hand or desk microphone, and also incorporates a metal loop to permit of hanging it in a convenient position. The microphone is extremely compact and light, weighing only 6½oz and the height is only 7in. At the thickest point it is 2¾in. tapering down to 1 1-8in at the base of the handle.

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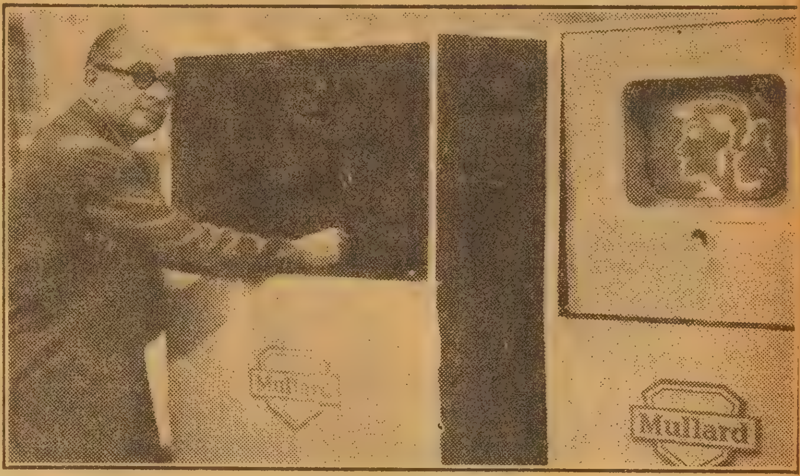
MESSAGES ON A RADAR SCREEN

A simple demonstration by a British cartoonist at a recent radio exhibition proved the practicability of a system whereby handwritten or documentary information can be "overprinted" on radar patterns or television images. It promises to be a development of major importance.

THE cartoonist was given a thick white pencil and, as he sketched one of his famous drawings, a baffled audience saw it appearing instantaneously on the screen of a cathode ray tube in an adjacent unit. And it remained there until the original drawing was wiped off the glass plate.

Arthur Ferrier was demonstrating the possibilities of an ingenious, yet simple, instrument specially evolved by Mullard electronic engineers to illustrate unusually effective applications of cathode ray tubes and photocells.

It is known as the Electronic Telescribe, and consists of two units linked by a single electric cable. As you write on the glass plate of the first unit, a small cathode ray tube and photocell transfers the pencil marks into electric currents. These are instantaneously conveyed to the second unit (a very slightly modified commercial television receiver) where they are changed back into a visible reproduction of the original writing.



Well-known cartoonist, Arthur Ferrier, demonstrates the Telescribe for the first time. Though the cartoon approach was used to intrigue the audience, the Telescribe would just as easily have handled hand-written flight data, code signs or ordinary documents.

ANY ILLUSTRATIONS

This simple equipment is fully capable of reproducing photographs, drawings and printed matter laid face down upon the glass plate and in this way it offers an excellent, and greatly simplified medium for picture transmissions.

While the model shown is limited to 200-line definition, Mullard engineers state that, with only a few minor modifications, this could be extended to a full 1000-line system. Under these conditions, picture reproductions of near-photographic quality could be readily obtained.

Although not originally intended as a commercial instrument, the principle of the Telescribe could certainly be adapted to a number of important practical applications.

Its most important application is undoubtedly the superimposition of maps on radar display screens. This has obvious value in all radar display systems.

It could also be applied to navigational radar control systems for aviation and shipping. It would, for instance, enable any operator controlling an aircraft and plotting its course, to superimpose the aircraft's identification and course on the display tubes of all other operators. In this manner it would at last be possible for all aircraft in a control area to be simultaneously identified and plotted on one screen.

The principle of the Telescribe would, in addition, provide a most effective method of passing and displaying informtaion in plotting and control rooms.

COMMERCIAL USE

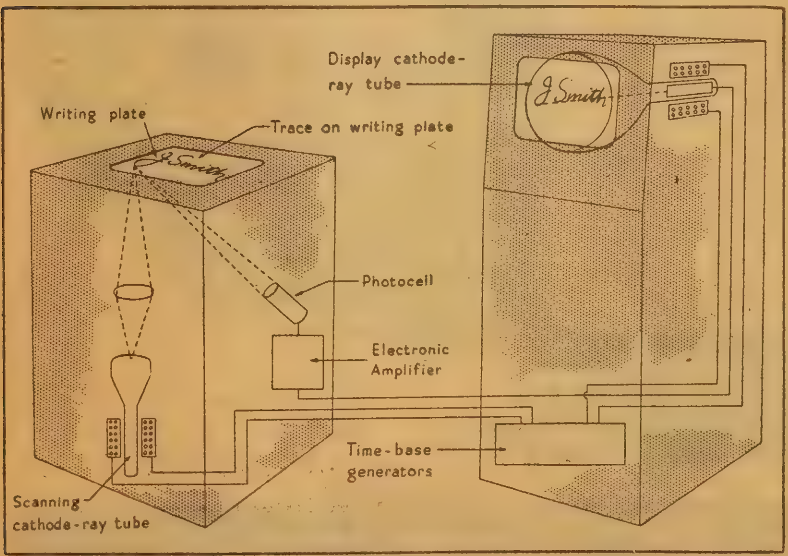
A simple instrument like the Telescribe could likewise be used in commerce and industry for transferring signatures (vide cheques in banking clearance, &c.) and printed matter very rapidly from one point to another for purposes of verification. It may thus provide simple, economic solutions of some of the problems of the banker, the businessman and the criminal investigator.

There also seems every possibility that this simple and reliable system will be of utmost value for the remote control of industrial processes, for example, explosives, nuclear reactors, &c.

The Electronic Telescribe utilises, in a special manner, the principle known technically as the flying-spot scanning technique. The time bases of two cathode ray tubes — one a "transmitting" and the other a "receiving" tube—are synchronised, or locked together electrically.

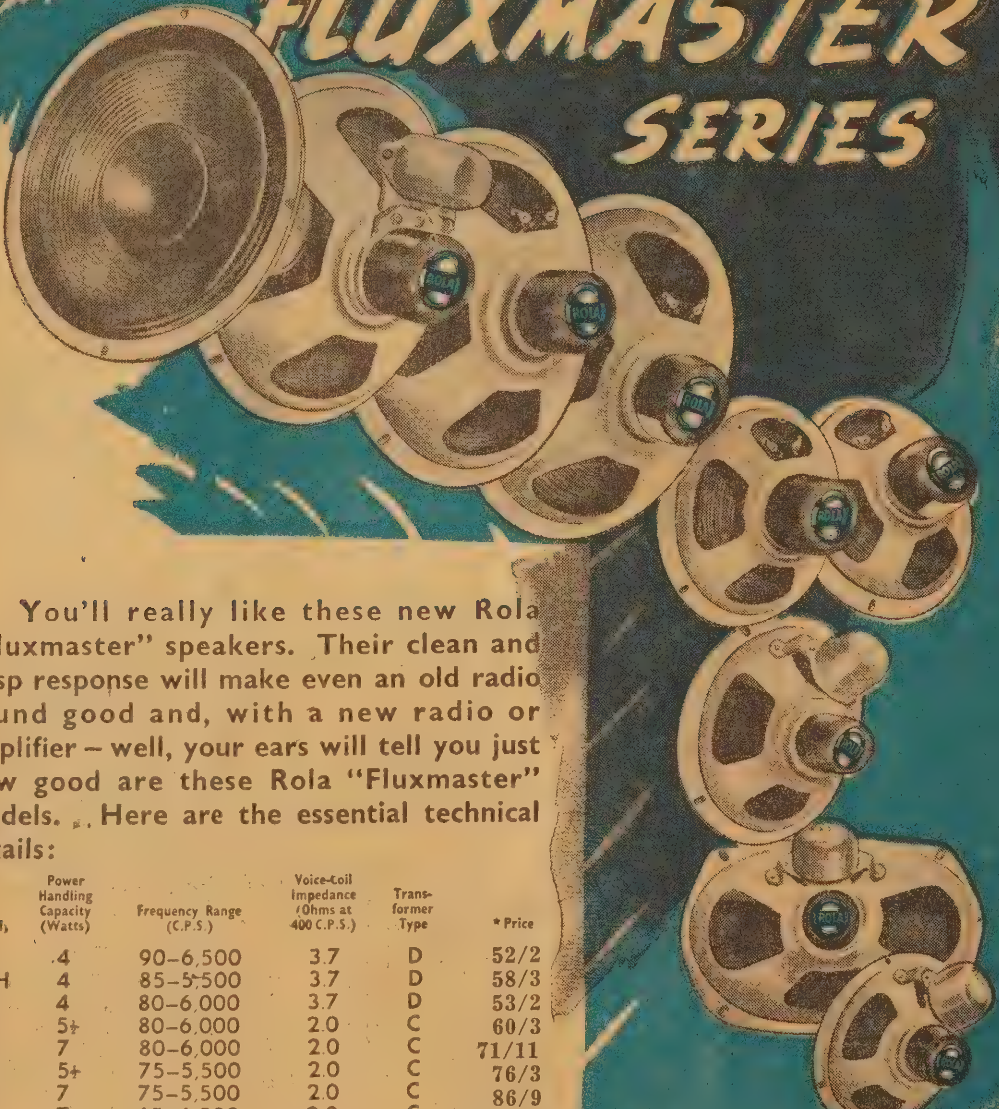
In the transmitting unit, a raster

(Continued on page 39)



How the Telescribe works. The photocell system must have high sensitivity and be equipped with an efficient optical system to collect the scattered rays reflected from the flying spot scanning tube.

NEW ROLA "FLUXMASTER" SERIES



You'll really like these new Rola "Fluxmaster" speakers. Their clean and crisp response will make even an old radio sound good and, with a new radio or amplifier – well, your ears will tell you just how good are these Rola "Fluxmaster" models. Here are the essential technical details:

Model	Power Handling Capacity (Watts)	Frequency Range (C.P.S.)	Voice-Coil Impedance (Ohms at 400 C.P.S.)	Transformer Type	* Price
6H	4	90–6,500	3.7	D	52/2
6-9H	4	85–5,500	3.7	D	58/3
8H	4	80–6,000	3.7	D	53/2
8K	5½	80–6,000	2.0	C	60/3
8M	7	80–6,000	2.0	C	71/11
12K	5½	75–5,500	2.0	C	76/3
12M	7	75–5,500	2.0	C	86/9
12·0	7	65–6,500	2.0	C	110/9
12·0x	6	50–12,000	2.0	–	174/10

* With Transformer, Includes 20 per cent Sales Tax.

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NUCLEAR POWER FOR WARSHIPS

The United States Navy is building an atomic-powered submarine which is believed to be near completion and, according to Rear-Admiral Wallin, work may soon start on an atomic-powered aircraft carrier. It has been officially announced that contracts have been placed for the construction of an atomic-powered aeroplane.

by Professor A. M. Low

DOES this mean, in spite of pessimistic forecasts about the time it would take to "harness" the atom, as distinct from using nuclear fission as an explosive, that the age of atomic power is just around the corner?

The answer to that must be qualified, but the successful construction of underwater, surface and air crafts powered by atomic "fuel" would represent a tremendous advance.

The technical details of the atomic submarine will be carefully guarded secrets, but there is no secret about the probable general design

BASIC ENGINE

The engine will consist of an atomic pile, probably using a fuel containing a considerable proportion of U235 in some form. The activity will be carefully controlled and the heat generated carried off by a liquid.

A liquid metal might be most efficient. This metal will be used to generate steam which will drive a turbine and then, through reduction gears, the propellers of the submarine.

The principle is fairly simple, the execution must be difficult, although a submarine offers special advantages. The pile and any stored fuel must be "screened" from the rest of the ship with great care so as to prevent harmful radiations escaping.

In the case of a submarine great strength would be required to ensure that the pile was not destroyed by the vibrations of depth charges dropped near.

The advantages are also enormous and explain why the United States has been prepared to spend many millions on an atomic submarine. In spite of the heavy screening of the pile, there might well be a reduction in weight because there would be no need to store fuel.

APPLIED TO SUB.

There would certainly be a great saving of space, always important in a submarine. There would be a reduction in noise and vibration, and the submarine would be able to stay submerged for very long periods without using a "Schnorkel." Oxygen would be provided and carbon monoxide absorbed.

The range of the submarine would be limited virtually only by the need to replenish it with oxygen, absorbent, food and torpedoes, although the additional space would enable larger supplies to be carried.

The atomic submarine, in fact, would be such a powerful weapon that some experts have suggested a small fleet of them would make all other vessels obsolete.

The construction of an atomic engine for an aeroplane would represent further difficultites because of the question of weight, but if the cost is no object the problem can probably be overcome. An atomic-powered aeroplane will have no need to refuel for days on end and possess a virtually unlimited range.

The question of economy hardly enters into military matters. It will be surprising if the atomic submarine is "economical" in the ordinary sense, although it may be fairly efficient from the engineering aspect of making good overall use of the energy available. It is expected to have an underwater speed of nearly 25 knots.

When what is learned in the construction of these atomic "engines" for special purposes comes to be applied to merchant vessels, economy will be important.

There is little advantage in constructing a liner that can run for years on a "handful" of fuel if the fuel and engine cost far more than the present orthodox methods.

POSSIBLE NOW

On the drawing-board it is possible to construct an Atlantic liner that will cruise at 30 knots for six months on a very low weight of U235. The cost of the fuel at present is such that it might not be economical, but we can expect this cost to fall.

Admiral Wallin has suggested that atomic engines for merchant vessels will be economical within 15 years, but this appears to be a somewhat optimistic view.

The advantatge they will enjoy is freedom from dirt—no funnels of

(Continued on Page 17)

MAY INTERCEPT ATOM BOMBERS

Most urgent task of a fighter in any future war would be to intercept and shoot down planes carrying atomic bombs. Most powerful fighter ever assigned to the RAF is this new Gloster type DA-5. Selected as Britain's primary atom defence weapon, the DA-5 is the world's first operational delta-winged aircaft. Powered by two "Sapphire" jets, It is especially suited for long-range and high-altitude operation Performance details are as yet a closely-guarded secret. The photograph on the right shows a DA-5 penetrating a cloud layer in a remarkable perpendicular climb.

THE CHEMISTRY OF COLLOIDS

Many of the everyday "mysteries" of science lie within the realms of the infinitely small for it is there that life begins and ends. Therein lies the explanation for many of the everyday phenomena which govern our well being.

by Calvin Walters

A foggy morning on Sydney's Broadway. The air is full of tiny water particles, too small to obey the natural laws of gravity, yet large enough to disperse light rays.

WE wash our hands—most of us, anyway! We eat meals and paint our houses. We have colds and attach rubber heels to our shoes. We drink water (sometimes) and stick wallpaper on the wall.

We don't do these things all at the same time, of course, and I have deliberately chosen them for their diverse character. Yet all depend on the infinitely small. In brief our field of inquiry this month is into the action of colloids.

COLLOIDAL SALARIES!

These days of struggle and strife for a seeming pittance may lead us to include that pittance as a colloid or an infinitely small particle. Or perhaps, that the infinitely small particle of, say, ham one gets for a specific sum of money the ham is a colloid. But I'm afraid it isn't.

Colloid chemistry has to do with the behavior of extremely small particles in relation to the surroundings. Those who want to be finnicky about definitions may find fault with this. I do not write for experts, however. They know all about everything already, although they usually disagree.

It is necessary, for the purpose of trying to elucidate this difficult matter, to reduce definitions to the simplest possible terms and still be near the mark. The above is it.

Just to show how important is this particle called a colloid particle, it may be stated that among the many substances which are known to exist in this state are blood, milk, vitamins, starch, smoke, viruses, gelatin, eggwhite, protein, soot.

The application of colloid chemistry to everyday life is important in the manufacture of butter and cheese, soaps and other detergents, and rubber tyres for the car—if you can afford one!

In the great field of emulsification, colloid chemistry holds an eminent position. And by emulsification I do not mean only the making of that horrible fish oil emulsion one avoids as much as possible. Emulsification includes such items as shoe polish, salad dressing, ice cream, ointment, face cream, insect spray and latex rubber solution.

The electroplating of metal and other substances depend on the colloidal state of matter. The purification of water, the making of glues and adhesives.

Having now awakened interest—I hope—to the value of colloid chemistry I will make an attempt to describe just what a colloid is.

We all know that everything in nature is made of particles of varying sizes ranging from the atomic size right up to the large aggregate of particles met with in the colossal stars which exist in outer space.

Above the atomic size is the molecular size which is usually defined as the smallest particle of an element or compound which is capable of separate existence.

NEXT TO MOLECULE

Above the molecular size is the colloidal size. Then comes the microscopic size and ocular, size visible to the naked eye.

It will thus be seen that the colloidal sized particle is below the microscopic size and is, therefore, invisible under the most powerful compound microscope.

There has been a good amount of argument among experts as to the actual size which can be defined as "colloidal."

The unit of measurement used for small particles is the micron, which is a mere one-thousandth part of a millimetre or one twenty-five thousandth part of an inch. This is quite a small unit indeed. Yet it is considered that a colloidal particle is about one-thousandth part of this.

It is very significant that this small size is the lowest at which life has been found to exist. A gene in the human body cell, chromosome, is a colloidal particle.

Colloidal particles have some very peculiar properties. They are not immediately subject to the laws of gravity, and, although they may be suspended in air or a liquid they do not settle as do larger particles. Before proceeding with the explanation of this phenomenon we will first explain how colloidal particles were first made "visible."

EARLY RESEARCH

About the middle of the nineteenth century an Englishman named Thomas Graham carried out experiments with membranes and found that certain molecules had the property of passing through membranes whose pores were of extreme fineness. Others were held back by the membrane. The latter he called colloids from the Greek word "kolla" meaning glue because Graham used a solution of glue in these experiments.

These particles retained by the membranes were not visible under the most powerful lens available.

The compound microscope was brought up to a fairly high range of magnification by the year 1900, but could not even then make visible any particle of a size smaller than a half micron, which is still very much larger than a colloidal particle.

There is an effect called the Tyndall effect after the investigator John Tyndall, who with Michael Faraday, conducted experiments relating to the passing of a beam of light through a colloidal solution.

The result of passing such a beam of light is the appearance of a whitish haze in the illuminated strip of solution. The effect is much the same as will be noticed when a beam of light passes through a dark room when particles of dust and smoke can be seen floating in the beam.

LIGHT SCATTERED

It is caused by the scattering of reflected light from the particles. The individual particles are not seen but only the aggregate of reflected light from a large number of particles. In pure water this effect is non existent.

In 1903 two German optical scientists developed an idea of using this effect to detect colloidal particles.

They devised a system where a beam of light was passed through a colloidal solution and the solution then inspected with a powerful compound microscope. The instrument was called an ultra microscope.

The colloidal particles appear as tiny specks of light which are in constant movement first dashing together and flying away from each other. The particles themselves still cannot be seen, but only the light reflected from the individual particles.

This movement of the particles is called the Brownian movement after the English botanist, Robert Brown, who a century before noticed that pollen dust particles were in constant movement. No explanation of this Brownian movement was forthcoming until 1905 when Einstein gave to the world not only his theory of relativity but also an explanation of the Brownian movement in itself of far-reaching importance.

Einstein said that this motion was brought about by the molecules of the substance in which the particles are suspended (called the continuous phase), striking the molecules of the suspended particles with such force that the latter are knocked around like footballs. Thus they are booted around in all directions which accounts for the peculiar zigzag motion as seen under the ultra microscope.

WHAT EINSTEIN SAID

Einstein's theory was that the molecules of a substance are always moving at high velocities. Colloidal particles are not of molecule size, but sufficiently close to act like them. The electron microscope has since shown this movement to be a basic phenomenon of nature.

The reason why colloidal particles will not settle out of solution is interesting. It was mentioned that the particles were not subject to the law of gravity.

It must first be realised that the particles are so small that the pull of gravity on each in average must be extremely slight, and [illegible] were it not for another factor they would eventually settle out over a long period of time. But these particles will not settle out at all, no matter what the period of time is. Why is this?

It is well known that when substances are subject to friction they accumulate a charge of electricity. The rubbing of a comb on a silk handkerchief is a familiar example.

Now colloidal particles are in constant motion and subject to friction and consequently they accumulate a charge of negative electricity.

EFFECT OF CHARGES

A well-known law of magnetism states that like charges repel. Thus each particle is insulated from its mates by like charges and thus prevents them from aggregating together in a mass. Each particle has its own envelope of negative charge which surrounds it like a field of magnetism, preventing it from colliding with its fellows.

The particles are so small that the pull of gravity is too weak and is overcome by the force of the electrical charges. This prevents settling owing to the fact that when a particle tries to sink it is forced back by the similarly charged particle below.

This property is of great importance. In substances like milk where the particles have a rather sticky surface they would cohere into a solid mass were it not for this electrical repulsion between them.

The surface charges also enable the particles to be moved about in such applications as electroplating.

ELECTROPLATING

It will readily be understood from the preceding that if a colloidal solution of a metal substance where the particles are electrically charged negatively has immersed in it a positively charged electrode, the negatively charged particles wil immediately flow to the positive pole or anode. There they will attach themselves and form a coating of the metal on the anode. This is not the whole story of electrodeposition, but is sufficient to give some idea of the principle involved.

The same method can be used to clear water of colloidal solid particles of such substances as clay. Here the negatively charged particles of clay will be attracted to the positively charged anode, where they will be deprived of their negative charges and fall to the bottom by the force of gravity.

In factory areas where the smoke from chimneys is a menace to the community an effective means has been found of depriving the fine suspended colloidal particles of their electrical charges and depositing them from the air. A positively-

Beaches, boys, towels and ice-cream seem to go naturally together. But ice cream would hardly be worth eating if colloids didn't behave as they do.

A MOVING COIL MICROPHONE SPECIALLY DESIGNED for SPEECH REPRODUCTION . . .

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Steane's "Dynamax" microphone is just one of the complete Steane's range and may be used with any one of a number of different microphone stands produced by Steane's.

The frequency response of Steane's "Dynamax" extends from 100 to 7,000 c.p.s., and has been made to rise slightly at higher frequencies, resulting in excellent intelligibility even under abnormally high extraneous noise levels.

The special design of the die-cast cage and front cover make the Dynamax withstand rough treatment and exposure to rain and dust. An exceptionally high output is obtained by the use of a high flux-density alnico magnet in a carefully designed magnetic circuit of low reluctance combined with an embossed lightweight aluminium alloy diaphragm coupled to a large diameter voice coil.

The finish is in black wrinkle with a chromium plated front cover.

TYPE	IMPEDANCE	CABLE (Shielded)	OUTPUT
S401	50 ohms	9 ft. Twin	.07 mV/μ bar
S402	Direct to Grid	9 ft. Single	1.3 mV/μ bar

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S1-52

charged wire is inserted in the chimney.

The colloidal soot particles must try to pass this wire, but are immediately attracted to it because of the positive charge on the wire. They are thus deprived of their charges and fall to the bottom of the chimney instead of drifting about in the surrounding kitchens and bedrooms of nearby houses.

EXPLOSIVE DUST

The same method is used to deposit dangerous flour dust in flour-mills. This dust can cause severe explosions if touched off by static electricity. It is electrically deposited in the same or similar manner to that of soot described above.

The latest method of making fine rubber articles like surgeons' gloves, toy balloons and rubber-coated wire mesh is by an electro deposition method similar to electroplating. Rubber latex as it comes from the tree is a colloidal substance. By immersing an anode, shaped like the article to be made, in the latex, the latter will immediately flow to the anode and deposit thereon. When the required thickness is deposited, the rubber is stripped from the anode.

In the purification of water recourse is made to the fact that certain chemicals have positive or negative ions or charges in their molecules. The hydrogen ion, for example, is positive, so that the addition of any chemical containing hydrogen to a colloidal solution of negatively charged particles will neutralise the charges on the particles and so cause them to settle out.

RUBBER SOLUTION

Aluminium sulphate is a chemical used for this purpose, also Ferric chloride, sodium chloride, magnesium chloride, because of the positive charges on parts of their molecules.

Those who have bought those small bottles of white latex with which to stick rubber soles to shoes have probably noticed that it smells strongly of ammonia. This is added to the liquid from the tree in order to counteract the effects of acid-forming bacteria which would otherwise form acid in the latex, thus neutralising the charges on the colloidal particles and thus causing it to coagulate in a solid mass before it was ready.

When the latex used for making sheet rubber is received at the works it is coagulated by adding acetic or formic acid. This curds it by the electrical discharge mechanism. The resulting curd is then formed into sheets.

In the making of ice cream there is a process called homogenisation. This is a method whereby the fat globules are broken up into a colloidal state and emulsified so that they do not separate from the body of the ice cream. The same process can be used to emulsify butter with milk to make cream.

Many colloids are what are termed the "gel" type. Such substances include gelatin, gum arabic, and other gums. It is believed that the fat globules of milk are covered with a gel-like protein and this prevents them sticking together. The action of a churn on butter-fat is to break up this protective colloidal coating, thus causing the fat globules to stick together in a solid mass.

SOME COLLOIDS WE DON'T LIKE!

Industrial chimneys don't have to smoke like this. Electrical methods can collect soot particles and thus recapture useful by-products.

Human blood contains many colloids in the form of proteins or chemical salts. The important red coloring matter of blood is a colloidal substance called hemoglobin. It is just as well that these substances are collodial in nature, otherwise our veins would be coated and finally blocked with sediment. Our brains would become clogged earlier than they otherwise do!

Fog is a form of colloid of finely suspended water particles which are too small to be affected by gravity. It will thus be seen that the colloidal state is one of nature's masterpieces without which everything would be a solid mass and many of the processes which go to make life a bit pleasant sometimes would be impossible. Even our beer would be always cloudy.

NUCLEAR POWER FOR WARSHIPS

(Continued from Page 13)

any kind will be required—and greater space for cargo or passengers, the whole of the considerable space now used for fuel being saved.

The Atlantic liner of the future may be wholly enclosed, the superstructure being of transparent plastics under which passengers will enjoy ideal conditions.

When we come to consider the application of atomic energy to driving land transport a furthter difficulty arises. There is always the risk of accident. The smashing of an atomic-driven car or even locomotive would mean that highly-radio active and dangerous material might be scattered.

These technical difficulties are in themselves not inconsiderable for the "engine" for land vehicles has to be reasonably small.

A small atomic pile could be constructed, but the fuel would be enormously expensive and the prospect that it would last a lifetime at no further specific cost would probably not weigh so much with the ordinary motorist as the great initial outlay.

Then there is the question of screening the driver and passers-by from harmful radiation. The neutron absorbing materials we know are very heavy. It is possible to think of engines encased in two or three-feet hick concrete in ships but not in road vehicles.

A more practical hope is that some method of storing electricity in "quantity," or inductive transmission, may be discovered.

One great trouble that overshadows the development of all methods of harnessing atomic energy is disposal of the "waste." In the past we have disposed of waste quite recklessly, pouring smoke into the air and all sorts of chemicals into the rivers and sea so that the water is polluted.

Radio-active wastes, however, are far more dangerous. It has been estimated that doubling the amount of radio-activity in the air would make it poisonous to man—and even present developments produce almost enough waste for that.

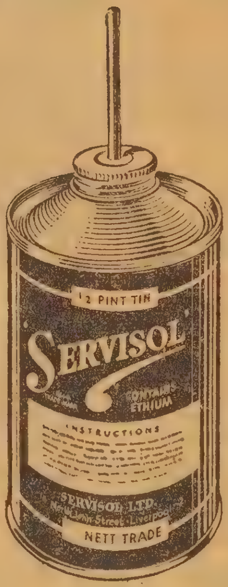
The waste products are, of course, most carefully guarded and prevented from doing harm, but we cannot overlook the possibility of accident, especially when the amount of waste is greatly increased.

A suggested solution is putting the waste into a rocket and then firing it into space with an "escape" velocity. The rocket would become a satellite of the world, going round it like the moon, at a distance at which any radiations would be harmless, although no doubt people would blame any bad weather on the "radio-active rockets"!

Conversion of "waste" to safe and useful products is far more likely in the future.

'SERVISOL'

THE Solution for removing instantly resistance in all Electrical contacts, switches, relays, etc., WITHOUT DISMANTLING



TO USE

Simply put a few drops on
NOISY VOLUME CONTROLS
SWITCHES
VARIABLE CONDENSERS
VALVE PINS
ON ALL ELECTRICAL
CONTACTS
and unwanted resistance

Instantly disappears!

★ 'SERVISOL' not only cleans switches, electrical contacts, relays, etc., but restores a film of lubricant which prevents oxidisation and corrosion.

★ 'SERVISOL' is used by the BRITISH BROADCASTING CORPORATION LEADING RADIO AND TELEVISION MANUFACTURERS P.M.G. and **ALL** technically sound SERVICE ENGINEERS

★ 'SERVISOL' and its efficiency has been proved over a period of many years. A good service department is never without it.

★ 'SERVISOL' IS A RADIO TRADE COMPONENT and as such can be obtained through your radio and electrical wholesaler.

SOLE AUSTRALIAN AGENTS:

JACOBY MITCHELL & CO. PTY. LTD.

BX3446 (5 LINES)

Sales and Showrooms, 277 Clarence Street, Sydney.

MADE BY SERVISOL LIMITED, ENGLAND.

Technical Review

NEW BATTERIES DOUBLE PLAYING TIME FOR PORTABLES

New radio "A" and "B" batteries of advanced construction, so outstanding in their performance as to be termed revolutionary, have been introduced to the U.S. receiver market by RCA Victor. The manufacturers are claiming double service life for a given size of battery.

THE new B battery, designated the VS216, is of the alkaline dry-cell type, with a voltage rating of 67½. It is the first radio battery to employ the type of alkaline cells formerly restricted to wet-type, non-portable batteries.

It is 22 pc smaller than present comparable batteries, and has an increased playing time capacity of 100 pc, when used in "Personal" portable receivers.

The new A is a redesigned version of the "sealed-in-steel" type and gives four times the playing hours of the latter.

The alkaline dry-cells utilise zinc, manganese dioxide and an alkaline electrolyte. The original alkaline cell, conceived years ago, was a wet-cell which was non-portable and had to be kept in an upright position. After years of research, the undesirable features of the original wet-cells have been eliminated with the development of the new alkaline "crown" type construction.

MORE EFFICIENT

The "crown" type cell is a self-contained unit which delivers more useful energy per unit of volume than do conventional types of cells and can be used in any position. Each battery is actually composed of two compact stacks of these exclusive "crown" type cells combined to give the correct voltage output.

After manufacture, the individual cells are stored for two weeks before being tested. This storage period allows the cells to stabilise and, at the same time, permits the detection of potentially weak cells. After acceptable cells have been stacked and assembled into batteries, the latter are tested and again placed in storage, this time for one week.

Following the second storage period, the completed batteries are re-tested. This double-ageing, triple-testing procedure, assures batteries of high quality.

Both A and B batteries are encased in steel to prevent swelling and wedging in the radio.

Balancing the capacity of both A and B batteries in a "personal" radio to give a life equal to one of the new B batteries, results in a playing time that compares favorably with that of most medium-size portables. In accomplishing these advantages, total battery space requirement is increased by only 30 pc.

The B battery was developed through continuous research over a three-year period at a cost of over a million dollars.

By designing a receiver to house A and B batteries with balanced life, instead of requiring frequently installation of torch cells for the A supply, the batteries can be ignored altogether for periods up to ten times that involved by the average small portable receiver.

NEW RECEIVER

RCA's new "personal" portable, housing a properly balanced set of batteries, weighs 3¾lb complete. It is 6in high, 9in wide and 2¼in deep, being comparable in size to an ordinary book.

Features of the set include full AVC, easy access to batteries and tubes, completely enclosed aerial and a "battery saver" switch which further saves the batteries by about 30 pc in areas where the full gain of the receiver is not required.

One of the new radio "B" batteries, designed to give longer life in personal portable receivers. No information is available as yet about price or the possibility of release of similar batteries in Australia.

A new precision telescope

(Continued from Page 5)

Andrew's University under the direction of Professor E. Finlay Freundlich. He is St. Andrew's University's first Napier Professor of Astronomy and has been lecturing there ever since 1939.

His right-hand man there who undertook the entire work of constructing the pilot model and is now busy on the larger telescope is Mr. Robert Waland, of Dumfries. Before he met Professor Freundlich he used to make telescopes as a hobby.

Today he is known all over the world as the builder of the first Schmidt-Cassegrain telescope.

In undertaking this important project, St. Andrew's University was helped finanically by the Education (Scotland) Fund, the Carnegie Trust and the Royal Society of Edinburgh.

"HIS MASTER'S VOICE"

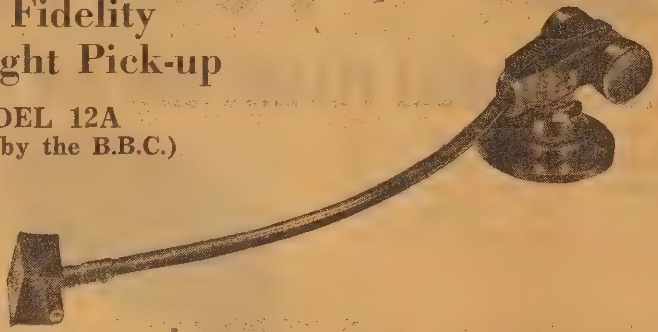
The Hallmark of Quality

Stocks now available

"HIS MASTER'S VOICE"

High Fidelity Lightweight Pick-up

MODEL 12A
(as used by the B.B.C.)



PICK-UP

Constant velocity type having an impedance of 8 ohms at 1,000 c.p.s.

Weight at needle point 1¼ ozs.

Reduced mass and absence of needle screw renders the unit capable of the highest quality of reproduction with a minimum of record wear.

Rotating head for ease of stylus change.

Extended arm for playing 16-inch records.

Robust construction and simple tubular arm ensures long life with rough handling.

A finger grip is provided for ease of operating.

Replaceable stylus plate enables quick and inexpensive repair if unit is damaged.

An output of 8 millivolts is realised from an average dance band recording.

Two matching transformers are available, if an equaliser is not to be used.

Type 28860B for working into high impedance inputs.
" D2469 for working into 200 ohms inputs.

EQUALISER

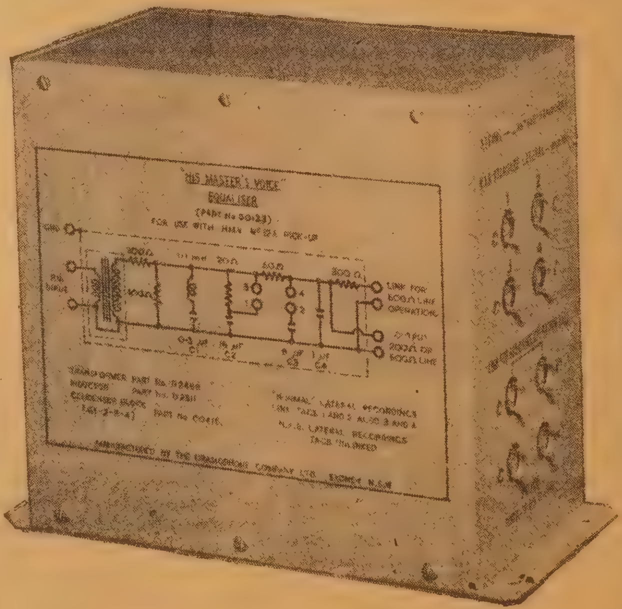
Designed for use with "HIS MASTER'S VOICE" Model 12A Pick-up to provide equalisation to suit the characteristics of both "Normal" and N.A.B. standard lateral cut recordings. Terminals are provided so that, when wired to a suitable control panel switch, either type of record equalisation may be selected. The equaliser output may be used with either 200 ohms or 600 ohms termination.

From the 1,000 c.p.s. band of a frequency record (Catalogue No. Z718), the following output levels are obtained when using Model 12A Pick-up connected to an H.M.V. Combined Equaliser.

EQUALISER	TERMINATION	OUTPUT LEVEL
"NORMAL"	200 ohms	— 49 dbm
N.A.B.	200 "	— 50 dbm
"NORMAL"	600 "	— 54 dbm
N.A.B.	600 "	— 55 dbm

Combined Equaliser Unit

for "Normal" and N.A.B. standard lateral cut recordings



Available from leading Electrical and Radio suppliers

State Distributors:

N.S.W.: E.M.I. Sales & Service (N.S.W.) Pty. Ltd., 301 Castlereagh St., Sydney.
Victoria and Tasmania: E.M.I. Sales & Service (Vic.) Pty. Ltd., 167 Flinders Lane, Melbourne.
South Australia: E.M.I. Sales & Service (Vic.) Pty. Ltd., 265 Rundle St., Adelaide.
Western Australia: Wyper Howard Ltd., 671-3 Hay St., Perth.
Queensland: A. E. Harrold, 123-125 Charlotte Street, Brisbane.

TV PROGRAMS RELAYED FROM PARIS TO LONDON

Television history was made recently when, for a whole week, viewers in London and Paris watched programs originating from the same cameras, yet transmitted to their homes on three distinct sets of standards. Engineers had successfully linked two countries and, at the same time, bridged the gap between 405, 441 and 819 line systems.

THE operation was a joint effort of the BBC and its French counterpart the RTF (Radiodiffusion et Television Francaises).

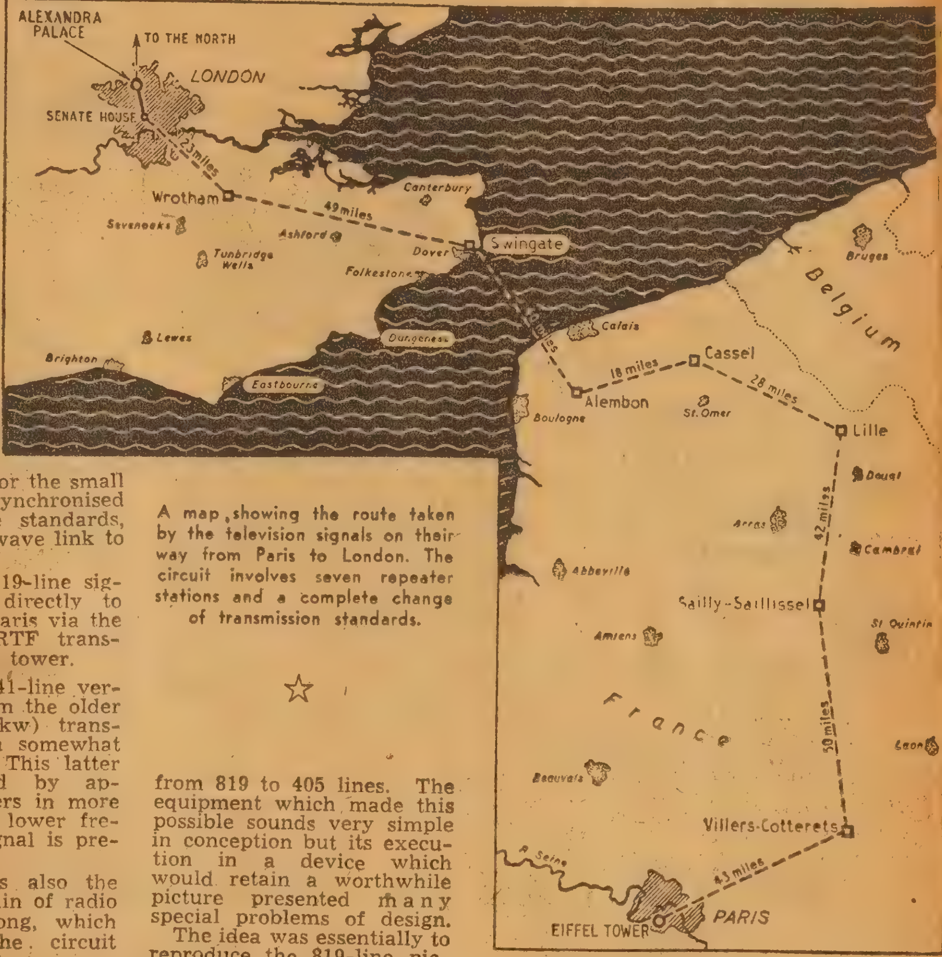
Designed to show a cross-section of life in Paris, the job of originating the 16 programs was shared between four mobile camera units. Two were French "outside broadcast" vans, a similar one was made available from the English Pye Company, while the fourth unit was a "suitcase" type engineered by the French Thomas Houston Co.

Using Image orthicons for the large cameras and a photicon for the small unit, signals were synchronised initially to the 819-line standards, then sent by centimetre wave link to the Eiffel Tower.

From this point, the 819-line signals were transmitted directly to some 25,000 viewers in Paris via the regular 819-line 3kw RTF transmitter at the top of the tower.

At the same time, a 441-line version was transmitted from the older and more powerful (30kw) transmitter, operating from a somewhat lower level on 46 Mc. This latter transmission is received by approximately 15,000 viewers in more remote areas, where the lower frequency, high-powered signal is preferred.

The Eiffel Tower was also the starting point for the chain of radio links, some 300 miles long, which ultimately completed the circuit through to London.



A map, showing the route taken by the television signals on their way from Paris to London. The circuit involves seven repeater stations and a complete change of transmission standards.

NORMAL LINK

The first part of the journey, from Paris to Lille, was made on the regular 819-line television relay link between the two cities.

This link has two unattended relay stations which are controlled by time switches and which use duplicate equipment as a precaution against breakdown. In each case, the equipment is mounted atop a 245ft tower, with two 10ft diameter paraboiic aerials. Some five watts of energy is beamed through this system at 850 Mc, with a gain in each repeater of about 90 db.

From Lille, two links were set up to carry the signals to Cassel, to a hilltop site which has served as a radio centre in two world wars. One link was simply direct reception of the Lille broadcast signal, the other a special 9000 Mc. link, the duplication again acting as a safeguard against possible breakdown.

Here the change was made from the French to the British standards, from 819 to 405 lines. The equipment which made this possible sounds very simple in conception but its execution in a device which would retain a worthwhile picture presented many special problems of design.

The idea was essentially to reproduce the 819-line picture with the highest possible definition on the screen of an 819-line receiver, then scan the screen with a camera operating on the British 405-line standard.

In the normal way, such a procedure would only result in a hopeless confusion of optical beats as the scanning spots passed one aonther in the process of scanning.

In addition, the slight and inevitable lack of synchronising between the nominal 50-frame standards of each system would inevitably cause creep between the time any one picture frame was reproduced and the time it was scanned, leading to a fluctuation in overall brilliance.

SPECIAL PHOSPHOR

The answer to the first problem was found in using a special phosphor with a persistance long enough to retain or "store" the picture for sufficient time to prevent it disappearing before the slower moving 405-line scan could sample it.

The overall fluctuation of picture brightness was overcome by specially selecting the operating conditions of the camera pick-up tube. This, with special compensatin circuits in the video system, allowe a picture to be obtained which di not suffer too great a degree of degradation.

The same idea, incidentally, wa used in the French system itself, t convert the 819-line pictures to 441 lines for domestic viewing. Previously the two services had run completely separate programs.

The rest of the journey the signal had to make from Cassel to London was accomplished via a series o VHF links operating in the region of 4500 and 7000 Mc. The 49-mil jump to Wrotham was very long for operating frequencies of thi order but was largely made possibl by a special new Klyston giving a output power of between 3 and 5 watts.

Other VHF links were set up in parallel with the television circuit links to enable instant communication to be had between engineering staffs at the various points.

The sound signals were conveyed direct from Paris to London via a land-line. (Wireless World.)

SPECIAL! AMERICAN COLLINS ART13 AUTOTUNE TRANSMITTERS

Output 125 watts from 813 modulated by push pull 811's. Freq. range 1500 Kcs to 18,200 Kcs continuously variable. 10 preset automatic channels.

Complete with all valves and fully filtered
28 volt input dynamotor power supply unit **£95**

GENEMOTORS

Midget type as illustrated, input 28 volts, output 250 V at 60mA. 35/-

28 volt input, output 330 volts at 135mA. Filtered 70/-

TR1133 type, input 12 volts, output 300 volts at .24 amps, 150 volts at .01 amps, 6 volts at 5 amps. Filtered 90/-

12 volt input, output 250 volts at 100mA. 55/-

6 volt input, output 250 volts at 100mA. 90/-

No. 11, H.P. unit, 12v input, 340 volt, 40mA. Output filtered. 35/-

D.C. GENERATORS

12v 750 watt. Ideal Homelighting, Battery charging, &c.

PRICE, £9/10/-, F.O.R.

RECTIFIERS

Full wave bridge copper oxide 100mA	4/6
Full wave copper oxide, 100mA	3/6
Half wave selenium, 5mA	3/6

Postage 6d each.

METERS

0-20mA DC 2½ inch Square Flush English Hobut. Brand new	30/-
0-10mA, DC 2 inch Round Flush	22/6
0-.5 amp, RF Thermocouple. New	17/6

FIELD STRENGTH METER-MONITOR

TYPE 98

Frequency range 100-30 m/cs or can be converted to any other freq. range by altering one coil. Complete with IN5G valve, imported 3-inch 0-1 MA meter and chrome-plated telescopic aerial. Jack provided for using meter for external measurements also necessary plug and lead. Batteries encased within the unit. Size 6½ x 7 x 7 inches. Supplied in portable carrying case.

Price, new complete, less batteries, F.O.R. **£4/10/-**

Weight packed, 15lb.

ELECTROLYTIC TYPES

1000mfd	12PV	3/-	200mfd	100PV	5/-
500mfd	15PV	3/-	50mfd	50PV	2/-

SANGAMO PRECISION TIMERS

48-hour jewelled movement. Can be run continuously or for one minute periods. Ideal for photographers, hobbyists, electrical flashes, signs, &c. **22/6**

Packing and Postage: NSW, 2/-, Interstate, 3/6.

HIGH POWER I.R.C. RHEOSTATS

250 ohm, 25 watt.
10 ohm, 2½ amp; 25 ohm 1 amp. Price, each **12/6**

Packing and postage, 1/- each.

CONDENSERS

Paper Filter Oil Filled

10mfd	400vw	8/6	1mfd	1000vw	6/-
8mfd	1000vw	25/-	0.5 mfd	3000vw	7/6
5mfd	350vw	6/-	0.25mfd	3000vw	7/6
2mfd	2000vw	20/-	0.25mfd	1000vw	2/6
2mfd	1800vw	20/-	0.1 mfd	3500vw	7/6
2mfd	1000vw	12/6	0.1 mfd	2000vw	6/-
1mfd	2000vw	10/-	0.02mfd	8000vw	4/-
			0.01mfd	5000vw	4/-

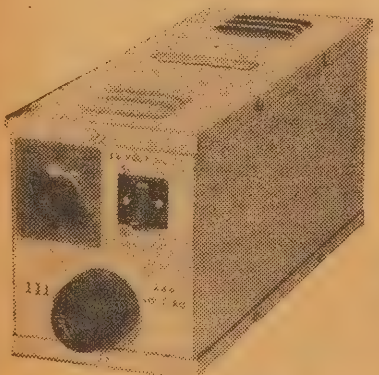
DISPOSALS VALVES TESTED

6AC7	15/-	12A6	10/-
6H6GT	7/6	12SG7	10/-
6SH7	5/-	12SK7	10/-
6SH7-GT	5/-	12SR7	10/-
717A	10/-	CV6	5/-
954	10/-	EA50	7/6
955	10/-	VT90	
956	12/6		
9001	10/-	Micropup	10/-

NEW VALVES

1K5	7/6	7193	7/6
1S5	12/6	7A6	10/-
3A4	12/6	7C7	11/6
3Q4	12/6	879/2x2	15/-
3S4	12/6	1293	11/6
6C8G	12/6	1294	11/6
6H6	10/-	VR54/EB34	5/-
6J5G	10/-		
6SQ7	12/6	VR65A	5/-
6x5GT	12/6	EF50	9/-

240 VOLT AC 50 CYCLE INVERTERS



FROM 12 VOLT BATTERY

Suitable for loads up to 200 watts. Excellent frequency stability. Radio interference suppressed. 3 pin power outlet socket.

Price £28/10/-

Suitable for emergency lighting or in conjunction with Radios, Radiograms, Portable Amplifiers, Tape Recorders, Synchronous Motors. Completely shielded in metal case 5 x 6¼ x 13 inches. Unpacked weight 19lb. TRADE ENQUIRIES INVITED.

Also available 32 Volt DC to 240 Volt AC 50 cycle at 100 Watts. Suitable for Radiograms. Price £28/10/-.

Please add exchange to all cheques. Make money orders and postal notes payable to Lewisham. Sorry, no C.O.D.

ELECTRONIC EQUIPMENT CO.

29b WEST ST., LEWISHAM, SYDNEY.
LM3555

We do not accept responsibility for any order damaged in transit.

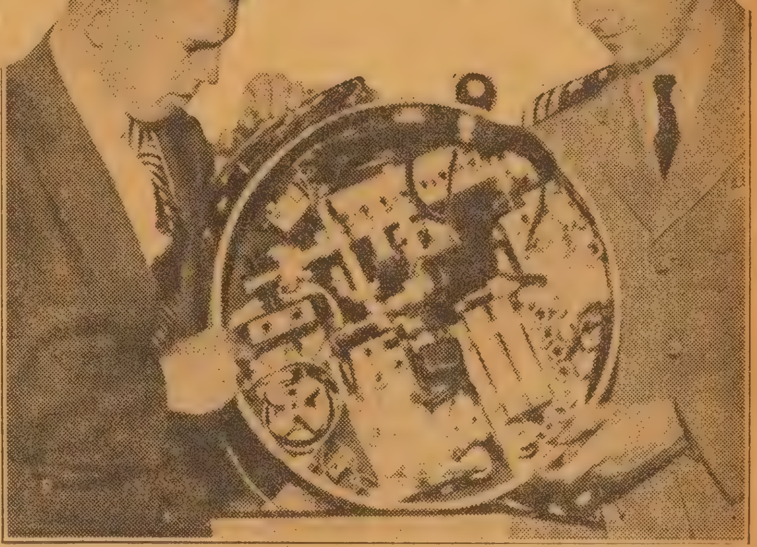
L/W RADAR HAS 200-MILE RANGE FOR MAPPING

Successful field operation of a new light-weight radar set that "maps" details of terrain and weather obstacles up to 200 miles in front of an aircraft was announced recently by the US Navy.

THIS advance radar unit is now in production for the Air Force and Navy and already has been installed on President Truman's plane, the Independence, and on various military air transports. According to W. W. Watts, of RCA, the instrument is also suitable for commercial aircraft.

At the present time, the equipment is being produced under Navy contract for military use only, and is scheduled for production under an Air Force contract.

Specifications for the new transport radar were prepared by the Navy Bureau of Aeronautics and co-ordinated with the Air Force to include recommendations reflecting its experience with radar.



Illustrating the size and compactness of the new light-weight radar, which is sealed and pressurised for high altitude operation.

ELECTRONIC EYES

According to Watts, the new unit permits the pilot to see a close-up of a selected area as if he were using a powerful telescope that could penetrate through darkness and clouds, and can be used for these four general types of operation:

1. As a means of collision warning. It will show mountains or other aircraft in the vicinity.

2. As an accurate indicator of weather conditions. It will show the position of thunderheads and other cloud formations, and will enable the pilot to avoid turbulent weather or select the safest course through it.

3. As a means of position location when standard landmarks are not visible. It can pick up the signal of ground-based radar range units.

4. As a means of mapping terrain. Through a special discrimination circuit, it shows the pilot the salient characteristics of the land over which he is flying.

The range of the system can be selected by the pilot for distances up to 200 miles from the plane. A selector switch permits the pilot to bring into view all obstacles and terrain within 5, 10, 30, 100 and 200 nautical miles of his airplane.

On a recent flight from Westover Air Force Base, Mass., to Frankfurt, Germany, in a military C-97 equipped with the new radar, the first islands of the Azores were observed at a distance of 195 miles from an altitude of 17,000ft. A technician aboard the flight stated that "the entire chain of islands was mapped with excellent definition, and navigation to Lages by radar was easily accomplished.

"On the same flight the landing approach at Frankfurt was made by means of the radar, with the runway clearly defined."

LIGHT WEIGHT

The device, designed solely for navigation and obstacle and weather detection, weighs a total of 173lb before installation and is pressurised to operate at altitudes up to 50,000ft. It is the first system of its kind to go into production that has both military and commercial application.

Operation testing of the set has been done in both Navy and Air Force planes. It is already reported to have prevented one serious crash. A passenger-packed transport had just taken off in foggy weather when the control tower erroneously instructed the pilot to make a right turn which would have taken him into the side of a hill.

Fortunately the pilot noticed the hill in his radar scope and made the correct manoeuvre.

SYNTHETIC FUTURE FOR MANKIND

(Continued from Page 7)

because these two properties are incompatible.

But he predicted that synthetic fibres will replace the natural fibres, with half the wool now consumed substituted by synthetics within 10 to 20 years, and this discovery of strong, durable, moisture-absorbing synthetic fibres to replace cotton.

The cotton-replacing plastics will replace natural leathers for shoe tops, for which artificial leathers are now unsatisfactory because they do not allow moisture of the feet to penetrate and escape.

Food crops, thanks to chemical modification of plant metabolism, will have the plant size dwarfed and the fruit, kernels or ears larger, Dr. Adams foresees.

The ultimate in insecticides, visualised by Dr. Adams, is a chemical, repellent to all insects and mites, innocuous to the plant and to higher animals, which when sprayed on the leaves will be absorbed and completely translocated by means of the plant juices.

Chemicals will be available in the future to sterilise the soil completely toward grasses and weeds but not toward the desired crop.

Oceans will furnish more of the world's food in the future, Dr. Adams believes, and there will be a more systematic fishing industry than at present with fish ranches, larger water areas fenced off and handled like cattle ranches. Marine plants for food, fuel or chemical use will be grown and harvested like land crops.

Chemicals to kill the viruses that cause such stubborn diseases as colds, poliomyelitis, meningitis, influenza, virus pneumonia, mumps and measles will be found in the next decades, Dr. Adams predicted.

The organic chemist will succeed in providing products which will eliminate susceptibles toward the degenerative diseases, such as cancer, heart disease, and arteriosclerosis.

Since hormones and other drugs affect the mental attitude as well as the physical well-being of people, Dr. Adams forecast that the future may bring us a series of drugs which will permit deliberate moulding of a person, mentally and physically. Control of such chemicals would be a great public problem. They would present dire potentialities in the hands of an unscrupulous dictator.—(Science News Letter.)

TELEPHONES: JA2877, JA2878 **FERGUSON LANE, CHATSWOOD**

STANDARD FERGUSON RANGE

For Output Transformers see other ad in this issue

RECEIVER POWER TRANSFORMERS

CODE No.	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS	RETAIL PRICE
PF185	240	150	30	6.3V/2A	43/11
PF299	240	285	40	6.3V/2A, 5V/2A	43/11
PF300	240	325	40	6.3V/2A, 5V/2A	45/6
PF201	240	225	50	6.3V/2A	44/8
PF151	200, 230, 240	285	60	6.3V/2A, 5V/2A	53/1
PF166	200, 230, 240	325	60	6.3V/2A, 5V/2A	54/-
PF165	200, 230, 240	385	60	6.3V/2A, 5V/2A	58/3
PF170	200, 230, 240	285	80	6.3V/2A, 6.3V/2A, 5V/2A	60/10
PF169	200, 230, 240	325	80	6.3V/2A, 6.3V/2A, 5V/2A	62/4
PF168	200, 230, 240	385	80	6.3V/2A, 6.3V/2A, 5V/2A	65/5
PF130	200, 230, 240	285	100	6.3VCT/2A, 6.3V/2A, 5V/2A	67/6
PF164	200, 230, 240	325	100	6.3VCT/2A, 6.3V/2A, 5V/2A	69/-
PF160	200, 230, 240	385	100	6.3VCT/2.5A, 6.3V/2A, 5V/2A	76/5
PF152	200, 230, 240	285	125	6.3VCT/3A, 6.3V/2A, 5V/2A	85/4
PF163	200, 230, 240	325	125	6.3VCT/2.5A, 6.3V/2A, 5V/2A	86/10
PF181	200, 230, 240	385	125	6.3VCT/3A, 6.3V/3A, 5V/2A	95/8
PF174	200, 230, 240	285	150	6.3VCT/2A, 6.3V/2A, 5V/2A	89/8
PF142	200, 230, 240	325	150	6.3VCT/2A, 6.3V/2A, 5V/3A	96/7
PF175	200, 230, 240	385	150	6.3VCT/2A, 6.3V/2A, 5V/3A	111/11
PF173	200, 230, 240	425	175	6.3VCT/3A, 6.3V/2A, 5V/3A	173/3
PF140	200, 230, 240	385	200	6.3VCT/3A, 6.3V/3A, 5V/3A	162/2
PF171	200, 230, 240	385	250	6.3VCT/4A, 6.3V/3A, 5V/3A	213/3

POWER AMP. AND LOW POWER TRANSMITTER UNITS

CODE No.	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS	RETAIL PRICE
PF159	220, 240, 260	475	175	6.3V/4A, 6.3V/2A, 5V/3A	188/9
PF172	200, 230, 240	500	200	6.3V/4A, 6.3V/3A, 5V/3A	213/3
PF143	200, 230, 240	600 500	200	2.5V/5A, 2.5V/5A, 5.5V/.5A	236/1
PF147	200, 230 240, 260	1000 750 500	200 250 300	5.5V/.3A	292/10
PF179	200,230, 240	475	225	6.3VCT/4A, 6.3V/2A, 5V/3A	183/1
PF107	230, 240	585	250	6.3V/3A, 6.3V/2.5A, 5V/3A	224/10
PF176	200, 230, 240, 260	1250	300	6V/.3	449/9
PF177	200, 230, 240, 260	1830, 1100	300	6V/.3A	Price on request

VIBRATOR AND A.C. POWER TRANSFORMERS

CODE No.	PRIMARY VOLTS	HTV aside	HT mA	FILAMENTS	RETAIL PRICE
PF182	240AC 12VIB	200	40	12.6V/1A	53/10
PF122	240AC 6VIB	220	40	6.3V/2A	54/-
PF125	240AC 6VIB	250	60	6.3V/2A	63/-
PF126	240AC 12VIB	250	60	12.6VCT/1A	63/-
PF119	240AC 6VIB	325	125	6.3V/4A	89/10
PF146	200, 230. 240 AC, 12, VIB	325	150	12.6VCT/2.5A	105/9

VIBRATOR TRANSFORMERS

CODE NR	PRIM. VOLTS	DC OUTPUT VOLTS	mA	BUFFER Full Sec.		RETAIL PRICE
VT100	32	200	40	.005		44/6
VT101	6	90	15	.008		34/10
VT102	6	150	25	.005		40/9
VT103	6	200	50	.005		42/11
VT104	6	250	60	.005		43/11
VT105	12	250	60	.005		45/6
VT106	6	300	75	.008		72/7
VT107	6	250	60	.005	Low Radiation	48/1
VT108	12	90	15	.008		36/3
VT109	24	90	15	.008		38/4
VT110	12	150	25	.005		42/11
VT111	24	150	25	.005		47/-
VT112	12	200	50	.005		45/-
VT113	24	200	50	.005		45/-
VT114	12	300	75	008		78/2
VT115	24	300	75	.008		79/-
VT116	24	250	60	.005		50/1
VT117	12	250	60	.005	Low Radiation	48/6
VT119	32	150	25	005		40/8
VT121	6	180	30	.005		45/-
VT122	6	400	50	.005		73/4
VT123	12	320	125	.005		94/5
VT124	32	250	60	.005		49/1
VT127	6	200	50	.005	Low Radiation	45/-
VT128	12	250	60	.005	Low Radiation	53/1
VT146	6 or 12	240AC	50W	1MFD.	For emergency light, etc.	64/2

POWER CHOKES

CODE No.	IND. HY.	DC RES	DC mA	RETAIL PRICE	CODE No.	IND HY	DC RES	DC mA	RETAIL PRICE
CF100	50	1900	10	29/6	CF109	20	225	150	56/4
CF101	30	870	25	28/9	CF110	12	100	200	65/5
CF102	15	300	60	22/5	CF111	16	165	200	65/5
CF103	30	420	60	42/2	CF112	10	70	250	65/5
CF104	30	580	75	44/10	CF113	.5/20	70	250 50	72/1
CF105	15	250	80	37/9					
CF106	12	200	100	38/2	CF114	1.1	23	375 AC	44/10
CF107	30	360	100	51/9					
CF108	12	135	150	53/11	CF115	.017	.6	2A	19/8

GRID INPUT TRANSFORMERS

CODE No.	MATCHING FROM	TO	NOM. IMPEDANCE PRIM.	SEC.	MAX. WATTS		RETAIL PRICE
MT104	Mike, P.U.	Grid	3.7, 50	50,000			44/10
MT105	Mike, P.U.	Grid	3.7, 50	60,000			164/1
MT108	Line	Grid	120	1200			98/11
MT109	Cath.	Grid	100	1000			56/2

LINE TRANSFORMERS

CODE No.	MATCHING FROM	TO	NOM. IMPEDANCE PRIM.	SEC.	MAX. WATTS		RETAIL PRICE
MT100	Line	Spkr.	600	4, 3	15		56/2
MT101	Line	Spkr.	500	15	15		56/2
MT124	Line	Spkr.	600 500	4, 3, 2.7 2.3, 2.	25		94/5
MT125	Line	Spkr.	600 500	15, 12.5 8.4, 6.5	25		92/2
MT111	Line	Spkr.	500	12.5, 8 2.3	10		60/7

MODULATION TRANSFORMERS

CODE No.	MATCHING FROM	TO	NOM. IMPEDANCE PRIM.	SEC.	MAX. WATTS		RETAIL PRICE
MT118	Audio Amp	Class C Amp	8000 6000 P.P.	10,000 7000 5000	25		148/6
MT119	Audio Amp	Class C Amp	8000 6600 3800 P.P.	10,000 7500 6500 5500 4500 3500	50		171/-
MT120	Audio Amp	Class C Amp	500 to 20,000 in steps	500 to 30,000 in steps	50		312/7
MT121	Audio Amp	Class C Amp	500 to 20,000 in steps	500 to 30,000 in steps	125		384/10

DRIVER TRANSFORMERS

CODE No.	MATCHING FROM	TO	NOM. IMPEDANCE PRIM.	SEC.	MAX. WATTS		RETAIL PRICE
MT106	Class A Driver S.E.	Class ABI Grids	5000 Step Up 1:5 Pri. DC 40 mA	125,000	6		98/-
MT107	Class A Driver HI. MU. S.E.	Class A Grids P.P. or S.E.	10,000 Step Up 1:3	90,000	1		143/-
MT112	Class A Driver HI. MU S.E.	Class A Grids P.P. or S.E	10,000 Step Up 1:2 5 mA DC unbalance	40,000	.5		89/11
MT113	Class A Driver S.E.	Class AB2 Grids	5000 Step Down 1.25:1 40 mA Pri. DC	3200	2		106/11
MT114	Class A Driver P.P	Class B Grids	5000 Step Down 1, 1.5 or 2	5000 2200 1250	5		122/7
MT115	Class A Driver P.P. or S.E.	Class B Grids	5000 Step Down 1.07 or 1.4 40mA DC max unb.	4400 2500	5		122/7

FILAMENT TRANSFORMERS

CODE No.	PRIM. VOLTS	SEC. VOLTS	RETAIL PRICE
PF117	240	2.5V/.3A.	29/1
PF118	220, 240, 260	2.5V/5A 2.5V/5A.	50/9
PF158	220, 240, 260	5V/8A.	56/2
PF138	220, 240	6.3V/4A, 5V/4A, 2.5V/4A, 2.5V/4A.	79/9
PF162	240	6.3V/3A, 6.3V/3A.	58/8
PF154	200, 230, 240	7V tap 6V/7A, 6.3V/3A, 5VCT/5A, 5V/3A, 2.5V/7A	168/8
PF102	240	7.5V/2A.	42/8
PF111	240	10V/5A	60/4
PF131	230 240	10VCT/10A, 5V/15A	179/11

ENGINEERED **TO-DAY** FOR **TO-MORROW'S** REQUIREMENTS

NEWS AND VIEWS OF THE MONTH

Microwave Links

THE use of micro-wave links for private enterprise is growing rapidly overseas. A micro-wave link takes the place of a telephone line over distances of 25-35 miles and can carry many channels at the same time. A number of micro-wave repeater stations strategically placed can cover long distances.

Many construction companies use these links to save the cost of laying wire, or in places where line laying isn't possible, as for instance across water. The two largest companies, Bell and AT & T, estimate up to 20,000 miles under service at the present time.

Television soon?

THERE is a feeling in the air that the Government might modify its present policy to halt all action on television, at least to the extent of allowing work to commence on one or more experimental stations.

The Postmaster - General, Mr. Anthony, has made no secret of the fact that he will spend some time on television during his visit overseas, and the Prime Minister was not allowed to conceal the fact, even if he so desired, by reason of several questions in Parliament.

An offer was made by a Melbourne firm to establish television stations in Australia, later to hand them over to the Commonwealth at cost. This offer is not likely to be accepted, not only because it would place the Government in a rather weak position on the whole affair but might even mean that it would not have complete control over certain aspects of standards and equipment, both of which it probably considers of great importance.

There are several reasons for believing that the Government might change its mind about television. In the first place, it has been the recipient of much criticism lately in many fields, and might be quite glad to escape further criticism on television. If its main objections have been on financial grounds, and there is every reason to believe this, then certain changes which have come about in our economy during the last six months or so might well inspire it to withdraw them.

As to the validity of such objections, and the ability of our economy to withstand the financial onslaught of television, only a financial expert could hazard an opinion. But it is quite certain that the radio trade would welcome a decision to start out on the trail, whether it be long or short.

Television has been just around the corner for more years than we care to count. Somehow we feel that if there was ever a need for the radio trade to overhaul brakes and accelerator, it is now. Their use when the corner is reached, plus considerable driver judgment, might well decide how many will get round the corner and how many will not.

Students and viewdents

AMONG the new words we apparently will have to get used to is "viewdent," a student who pursues his studies by means of television, and can get a real diploma at the end of them if American plans come to anything.

One university—the Iowa State University—operates its own station, but there are 242 channels out of 2000 new TV outlets set aside for education. It's a certainty that seats of learning will take up many of these, and maybe compete for business over the air!

The University of Michigan, and Western Reserve University of Cleveland both run TV courses at pre sent, using existing TV stations. Su jects include Economics, Musi Psychology, Literature, &c. Examin ations are held at the Universit itself.

Western Reserve uses its regula professors for lectures. Studen pay five dollars for registration, u to eight dollars for textbooks, an up to 50 dollars for tuition. Ques tions are answered either by phon or by mail.

A second order student pays th registration fee, buys the textbook if he wishes, but gains no final recognition from the University, whic does not guarantee to answer hi questions.

The third class of students pay nothing, but just receives the program all the same. To these apparently the University extends it blessing, not being able to do ver much else!

Station WEWS donates the tim for lectures, and says the course i the best early morning program i has been able to get in its fiv years of life. Time—early mornin before 9 am.

According to students many o the professors were just terrible during their first weeks on the air. But with practice, they have become adept at packing 50 minutes work into 30 minutes. But, after all, isn't that an American way?

Green fireballs

TALKING of saucers and things, reports have come from New Mexico of strange, green fireballs which suddenly flash out of the sky and scare the daylights out of those who see them.

Observers are convinced that these are not the same thing as flying saucers nor have they any apparent similarity to them.

Dr. Lincoln La Paz of the New Mexi-

POPULAR SCIENCE QUIZ

Q.: How do x-rays destroy diseased tissue without affecting healthy parts of the body?

A.: There is no preferential action by which x-rays destroy tissue that is diseased more quickly than if it is healthy. They do destroy rapidly-growing tissue more quickly than tissue that is growing more slowly. This is because the cells are particularly sensitive to radiation when they are dividing, and increasing their numbers. Cancerous tissues are characterised by rapid growth, and that is why x-rays can be used to help control them.

Q.: How long does it take the Sun's light to reach the planet Pluto?

A.: Pluto is about 3,666,000,000 miles from the Sun. Since light travels 186,000 miles per second, or 11,160,000 miles per minute, it would take about 5 hours 28 minutes for the Sun's light to reach Pluto. In contrast, it reaches the Earth, which is about 93,000,000 miles from the Sun, in a little over eight minutes.

Q.: What is the difference between the terms mean, average and median, as used in connection with statistics?

A.: Average and mean are the same. In their most common usage they refer to the value obtained by adding the various items and dividing the sum by the number of items. The median is a member of a series chosen so that there are just as many above as below. Suppose in a family there are five children, aged 4, 6, 7, 10 and 13. Their average age would be eight (40 divided by 5), but the median age would be seven, since there are two older and two younger than this.

Q.: To what does the term "Mycology" refer?

A.: Mycology refers to the study of mould, rust and other fungi. Here, as in the study of entomology, biological control plays an important part. An interesting example of this is illustrated in a case in Western Australia where citrus-fruit orchards were attacked by a virulent fungus pest. In Florida, a similar pest had been doing a lot of damage.

Naturally enough, the steps taken in Florida to combat the pest were carried out in Western Australia. However, there was no change in the situation, the parasite which had been introduced for the purpose had no effect on the fungus causing the damage to the crops.

Advice was sought from the Imperial Institute of Mycology in Britain. The outcome of investigations by this institute was that the fungi operating in Western Australia had a totally different life history to that which had given similar trouble in Florida even though the fungi were outwardly similar. The West Australian fungi had to be attacked with a different parasite.

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1636-3H	200-220-230-240	300	80	2 x 6.3V-2A; 5V-3A	42/9
1332-3H	200-220-230-240	300	120	2 x 6.3V-2A; 5V-3A	53/3
1356-3H	200-220-230-240	400	150	5V-3A; 2.5V-5A; 6.3V--4A	70/-
1380-3H	200-220-230-240	450	200	2 x 6.3V-2A; 5V-3A	102/6
1371-8	200-220-230-240	500-600-750--850-1000	300	—	150/-
1400-19	200-220-230-240	565-500-425	250	2 x 6.3V-3A; 2 x 2.5V-3A; 5V-3A	110/-
1643-23	200 or 230 or 240	—	—	6.3V TAPPED 5V-2A (500V INSUL.)	17/6
1525-21	200-230-240	—	—	2.5V-10A (1000V INSUL.)	47/6
1305-22	200-220-230-240	—	—	2.5V-10A (3000V INSUL.)	75/-

FILTER CHOKES—SWINGING CHOKES MARKED *

TYPE AND MOUNTING No.	INDUCTANCE-HENRYS		CURRENT mA	APPROX. DC RESISTANCE OHMS	MAXIMUM DC Working Voltage	PRICE
	MAXIMUM	AT FULL RATE DC				
975-23	20	15	50	320	500	16/6
973-9	30	20	80	370	500	33/6
973-21	30	20	80	370	500	25/9
1012-1A	35	20	120	430	1000	35/3
967-1A	35	20	150	200	1000	46/-
956-1A	30	20	200	160	1000	57/9
1011-1A	30	15	250	160	1000	59/6
* 983-1A	25	20/5	30/300	90	1000	65/6
986-1A	15	10	300	60	1000	62/6

MOUNTING DETAILS:

—3H: Horizontal mount with steel louvred cover. Sub-terminal panel.
—8: Open steel clamps.
—19: Horizontal 6" x 5" cast cover.
—23: Open steel brackets.
—9. Diecast case with solder terminals.
—21: Open steel clamps.
—22: Open steel clamps.
—1A: Vertical steel louvred covers.

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can University thinks they may be a new type of meteor. He thinks they are new because they are more brilliant than usual, they are silent, they follow a straight line and their green color is quite unusual.

He speculates that their composition might be such that, although they are made of matter like anything else, their electrical charges characteristic of their atomic structure are reversed as compared with matter in the earth. Coming into contact with the earth, therefore, one would expect a terrific explosion to result. He discounts the possibility that they have connection with earth-made missiles, and is anxious to meet someone who has managed to find a piece of fireball which has not disintegrated.

All in all it looks as though we are likely to have an interesting time of it for the next few years!

Fine IRE Exhibition

A PARTICULARLY impressive exhibition of Australian-made equipment was shown at the Hotel Australia in Sydney during the Institution of Radio Engineers' Convention last month.

The exhibition was something of an eye-opener to many of the overseas visitors to Australia for the tenth assembly of URSI, many of whom had no idea that Australian factories could produce equipment of such a high standard of workmanship and design.

Congratulations to the organisers and the exhibitors for an excellent show.

Low Speed Ahead

ACCORDING to reports from USA, the low speed records are taking over from the 78 speed with quickening tempo. Considering the number of years the 78 speed has been with us, the acceptance of the new speeds has been remarkable. Few things were ingrained into our listening habits as deeply as the 78 record.

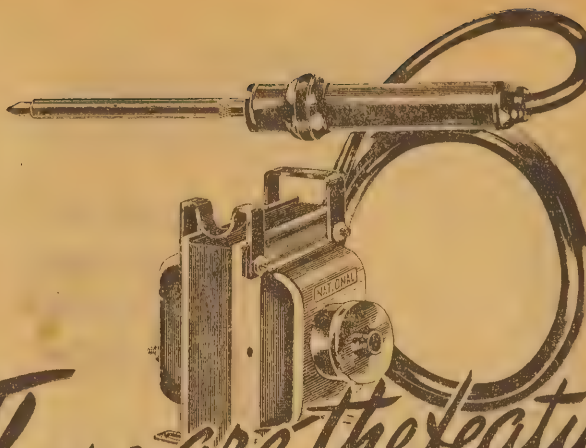
Reports seem to confirm the view that 45 and 33 rpm will settle down to a side by side existence—one for long playing mainly in the classical field, and the other in the popular field.

Columbia says that the new speeds now take up 45 per cent of its business, and RCA expects this year's business to show only one-third occupied with 78's.

Figures show that in 1951, 128-million 78's were made, 34½-million 45's and 6½-million 33's. But, because of the higher price, the 33 records brought in about one-quarter the revenue of all the 78's.

The record business in USA seems to be in something of a slump at the moment, but the total value of sales is still increasing. American record business, including discs made for overseas sales by various overseas subsidiaries and domestic sales of imported records was worth 284-million dollars in 1951.

There has been much speculation whether TV will prove a counter attraction to records, whether people would prefer to look rather than to listen. But the major record companies insist that records are selling better in TV areas than elsewhere. It may be hard to draw conclusions from this, but it seems reasonable to think that cheap, convenient record-playing will always be able to hold its own.



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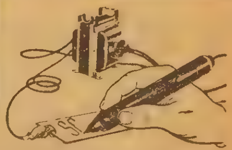

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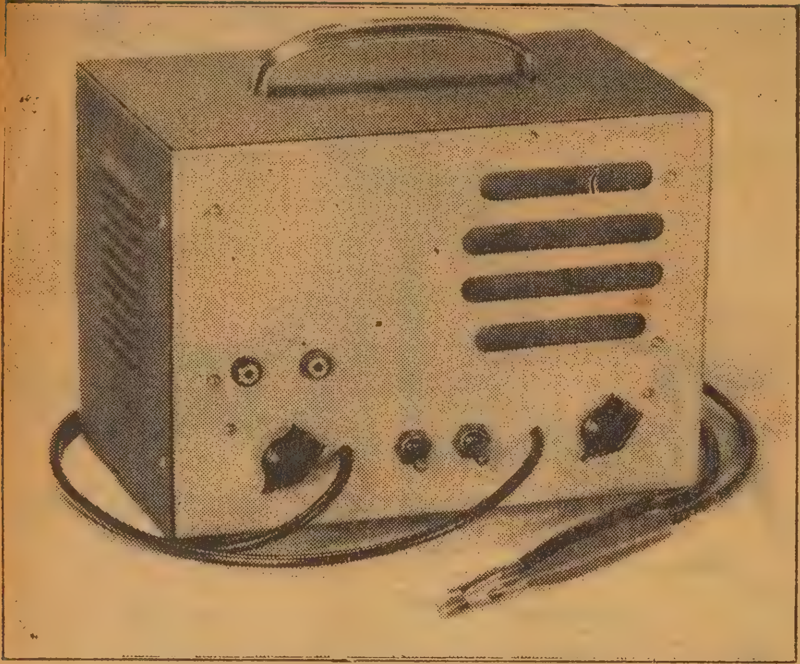


The complete tracer, housed in a metal box with a suitably engraved panel, is quite a neat instrument. The RF gain control is on the left, then comes the RF lead, the "RF-AF" switch, the speaker "ON-OFF" switch, the AF lead and the AF gain control. The lighter (red) prod is the RF probe and the black one the AF probe.

R & H JUNIOR SIGNAL TRACER

The signal tracer is now a well established service instrument and we have had many requests for constructional details. The unit described here is no harder to make than a simple receiver but is really a good performer and will save any serviceman much valuable time.

by Philip Watson

BASICALLY a signal tracer is a device which enables an observer to tap into a receiver, or similar piece of equipment, at any point and note the quality and strength of the signal at this point.

In a very simple form it could consist of nothing more than a pair of headphones with an isolating condenser in series with one lead. With such a device it would be possible to check the signal at various points in an amplifier or the audio end of a receiver and thus assist in the location of a faulty stage.

LIMITATIONS

As with most simple things, such a scheme has serious limitations. Quite apart from the fact that it will only respond to audio signals, it is quite likely that the available range of signal strength would be more than it could handle, the level being inconveniently weak at the input and dangerously strong at the output.

In addition, the user would eventually run into the problem of "loading," or the adverse effect on performance of the unit under test caused by the presence of the tester.

This loading effect is one of the most serious disadvantages of many simple designs and limits their usefulness considerably. It can usually only be reduced to reasonable proportions by decreasing the coupling between the unit and the tracer, a process which, in turn, seriously affects the sensitivity.

Since adequate sensitivity is also important, it generally becomes necessary to strike a compromise between these two requirements and, at the same time, to provide a high order of amplification to keep both within reasonable limits.

In order that signals may be observed at all parts of the set, rather than in the audio section only, it is necessary to provide some form of detector which will change RF or IF signals into audio signals.

One popular method uses a valve, in a probe, operating as a leaky grid detector and passing the audio signals onto the main part of the tracer for further amplification. In these designs the same probe is frequently used as audio probe as well, the resulting distortion at high audio levels being an accepted limitation of such a simple design.

Another method is to use a small diode valve in a smaller probe and to provide the necessary amplification in the main part of the unit, often with a separate probe for the audio section.

In more elaborate systems one or more tuned circuits, with amplifying valves, are used ahead of the detector and the whole unit is very similar to a high-gain TRF receiver to which has been added the necessary probes to enable it to explore the receiver under test.

As well as enabling the signal being observed to be identified in terms of frequency, the extra stages provide worthwhile additional gain, a feature which is valuable where broadcast signals are weak and where, for one reason or another, it is not convenient to use a signal generator. The ability to determine the frequency of the signal is mainly useful around the converter stage to check the performance of the local oscillator.

The introduction of tuned stages immediately introduces a number of problems which places the instrument outside the simple experimenter class and, while we have in mind to produce such an instrument at a later date, we felt that there is a definite need for a design which will do most of the things that a larger one will do but which is considerably simpler, and cheaper, to build.

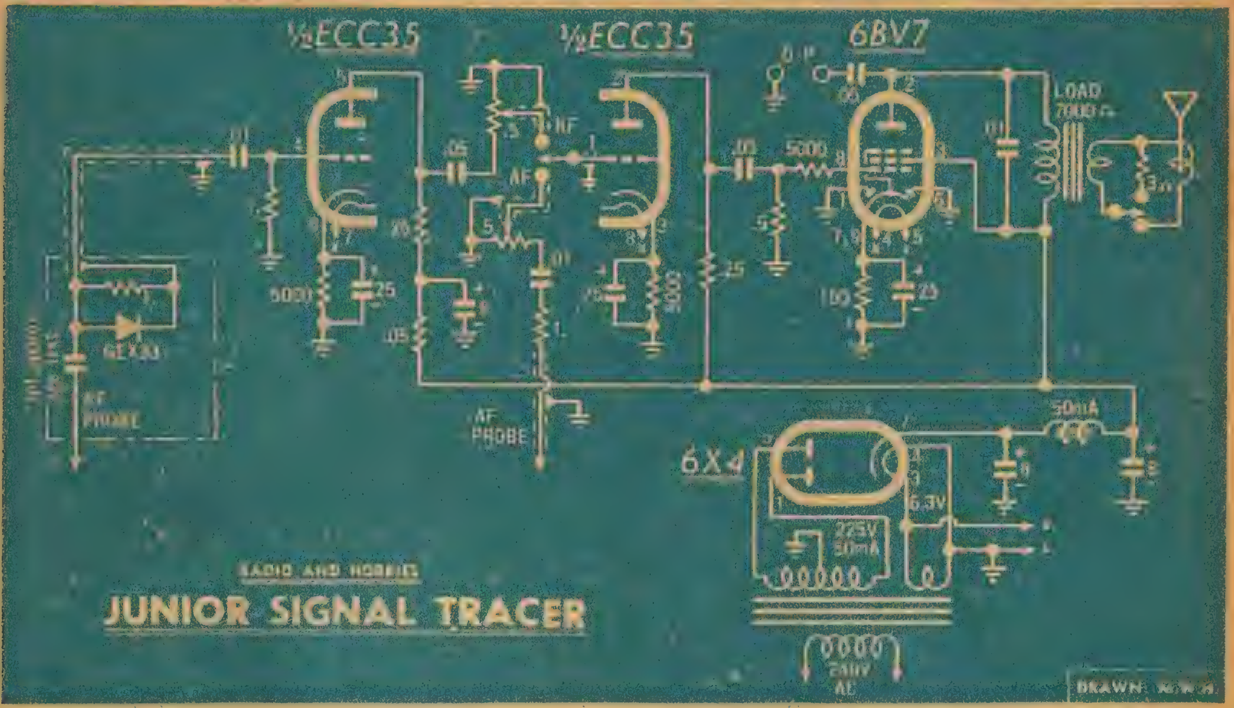
The final result is, we feel, an excellent compromise between all factors and, although it does not employ tuned circuits, it would be a valuable addition to any service bench, whether amateur or professional.

OUTLINE OF CIRCUIT

Basically, the unit consists of a diode detector in a probe followed by a high gain audio amplifier on the main chassis. A separate probe is used for audio tests and switches and volume controls are provided to make the unit as versatile as possible.

One feature is the use of a germanium diode, which has the advantage over the valve diode that is is very much smaller and requires no filament supply, characteristics which make it possible to house the diode and its load resistor in a standard meter test prod.

CIRCUIT USES FEWER PARTS THAN A SIMPLE SET



The circuit is really that of a high gain audio amplifier preceded by a diode detector. Note particularly that pin 4 of the ECC35 should be used for the first grid in order to avoid hum trouble and that the .05 mfd capacitor from the plate of the 6BV7 should be mounted above the chassis to avoid audio instability.

Having decided on the use of this diode we conducted some experiments to determine just what degree of coupling could be tolerated between it and the circuit under test before serious loading effects were observed.

It soon became apparent that a very small capacitance, about one or one and a half pf, was all that could be used as a coupling capacitor and this presented something of a problem, because the amount of signal available under these conditions is very small and a lot of amplification is necessary to raise it to a useful level.

AC OR BATTERIES?

We also had to decide whether to make the unit a battery or AC operated one, there being some points in favor of both. We finally decided that the AC version had several strong points in its favor, not the least of which is the fact that these devices often have to be run for long periods when intermittents are being chased and the cost of batteries may be excessive under these conditions.

Then it became necessary to decide what order of audio gain was necessary and how this could be most conveniently provided. A high-gain pentode, such as the 6AU6 with a gain in the order of 300, proved inadequate when fed into a 6V6 and we turned our attention to the high-gain twin triode, ECC35. Each section of this has a gain of 45 so that the two in cascade have a total gain of over 2000.

To make the most of this combination we substituted the new 6BV7 output valve which requires only 5 volts audio drive for full output compared with the 12 volts for the 6V6.

This combination proved a very effective one and the sensitivity is such that useful output is obtained from the tracer when it is connected across the first tuned stage (i.e., the grid of the converter) and the set tuned to a reasonably strong local station. In some country locations signals may be too weak to be heard when connected to this part of the set and it may be necessary to use a signal generator.

When connected to the plate of the converter the signals will be much stronger and, from this point onwards, broadcast signals could be used in most localities.

Another advantage of two medium-gain stages over a single high-gain stage is that it is possible to feed signals from the audio probe into the circuit at a more convenient level and, in this case, it was found that the second triode stage alone provided all the gain that was needed.

To make the unit really versatile we arranged a change over switch in the grid circuit of the second stage, connecting it to either one of two volume controls, one going to the plate circuit of the previous stage and the other to the audio probe.

This feature enables the unit to be connected to both the IF (or RF) and audio ends of the set at the same

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2 Tip jack sockets
3 1 meg. ½ watt resistors
1 .5 meg. ½ watt resistors
2 .5 meg. potentiometers
2 .25 meg. 1 watt resistors
2 5000 ohm 1 watt resistors
1 5000 ohm ½ watt resistors
1 150 ohm 3 watt resistors
1 3 ohm 3 watt resistors
1 Radio and Hobbies instrument box 9" x 6½" x 5½"
1 Engraved panel 9" x 6½"
1 Chassis 5¼" x 8"
1 Power transformer 225 volts, 50 mA 6.3 volts, 2A.
1 filter choke 15H, 50 mA.
1 5" speaker with 7000 ohm transformer.
1 ECC35 valve
1 6BV7 valve
1 6X4 valve
1 GEX33 germanium diode
1 Octal socket
1 Noval socket
1 Miniature 7 pin socket.
3 25 mfd 40 volt electrolytic capacitors (midget).
3 8 mfd 350 volt electrolytic capacitors
3 .05 mfd 400 volt paper capacitors
1 .01 mfd 400 volt paper capacitors
2 .01 mfd 200 volt paper capacitors
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1 4 Terminal tag strip
3 3 Terminal tag strip
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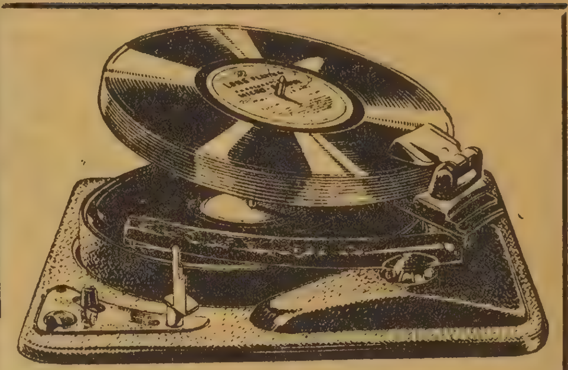

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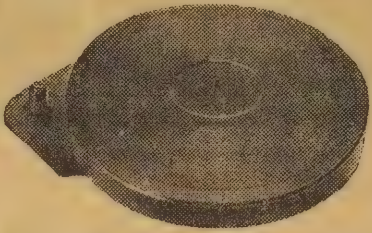

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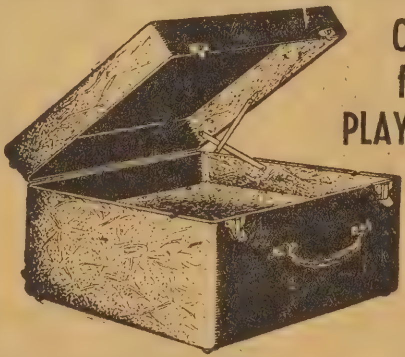

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Since separate volume controls are provided it is possible to balance the output from the tracer so that it is identical from both probes when the set is functioning correctly. Should a change in volume now occur in the set it is only a matter of seconds to determine whether the fault lies before or after either of the probes, thus considerably reducing the area to be further investigated.

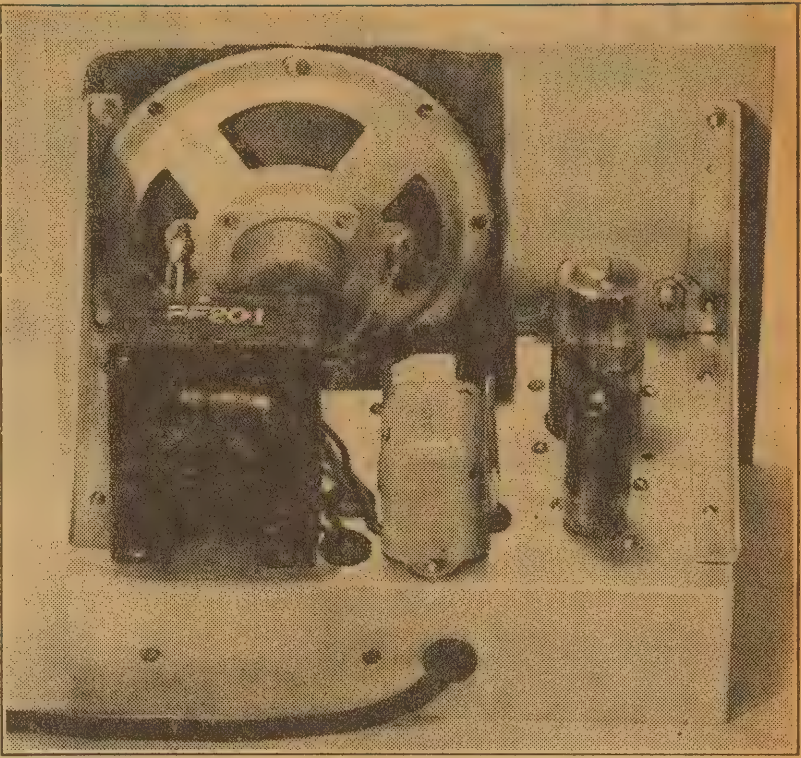
If, at the same time, the AVC line can be monitored it is possible to divide a set into four separate parts, being the four main stages of a normal set, and to determine, at the first failure, in which of these sections the fault lies.

The audio probe connects to its volume control through a 1 meg. resistor and a .01 mfd capacitor, the former serving to minimise loading effects and the latter to prevent short-circuiting any points carrying DC voltage. The values chosen proved quite effective and no noticeable loading effects could be observed in the audio section of a normal receiver.

Provision is also made to silence the speaker by switching the output of the transformer to a 3-ohm resistor instead of the voice coil, while a pair of terminals on the panel enable an output meter to be connected in the 6BV7 plate circuit.

This arrangement is often most convenient when searching for intermittents and, when a signal generator is available, the performance of the set being checked audibly and that of the tracer on the meter. By this means confusion between the two speakers is avoided.

A REAR VIEW OF THE TRACER



This rear view photograph gives a good idea of the general layout. The ECC35 is toward the front panel and the 6BV7 towards the rear. The 6X4 is behind the power transformer. Note the .05 mfd capacitor mounted above the chassis.

MECHANICAL DETAILS

So much then for the general features of the instrument, now for some of the constructional details. The unit is built on a chassis and panel designed to fit a Radio and Hobbies standard instrument case and, although not unduly crowded, a little care was necessary in the placing of some of the larger components.

The speaker is a 5in Rola, this being considered the minimum size which would give satisfactory results for this kind of work. An Amplion or Jensen type will also fit into available space, but it would be as well to check carefully on other makes of the same nominal size, since an extra ¼in may prove embarrassing. We mounted the speaker transformer on the chassis but where this is already mounted on the speaker it may be left there.

The AF volume control cannot be mounted directly behind the front panel in the logical place, due to the position of the speaker. In order to preserve a balanced appearance this was mounted on a small bracket about an inch behind the panel, the shaft as normally supplied being long enough to reach through the front panel.

The power supply is quite straightforward, the miniature 6X4 rectifier being used mainly to save space. In some cases it would be possible to substittue the larger 6X5 but much depends on the type of speaker and the space it occupies. The plate supply to the first triode is decoupled by means of a .05 meg. resistor and an 8 mf electrolytic, a precaution which is necessary to eliminate both hum and instability.

Because of the high gain, hum may become a problem if care is not taken and a few points are worth noting. As indicated on the circuit, the triode using pins 4, 5, and 6, should be used for the first section since this locates the grid pin well away from the heater pins. In the second section the grid pin, pin 1, is alongside the heater pin, pin 8, but the gain at this point is not sufficient to cause trouble.

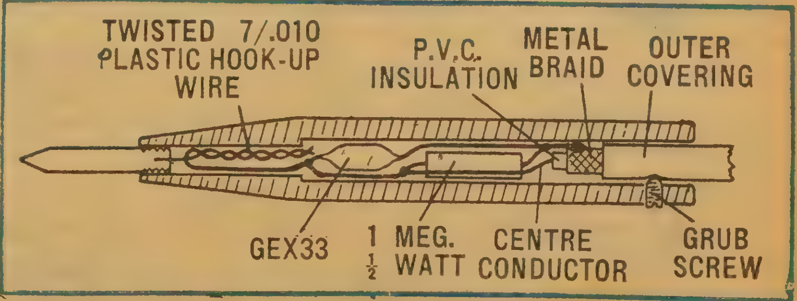
However, long leads in this circuit will need to be shielded, particularly as some of them run alongside heater leads. Three such leads are used, all coming from "RF-AF" switch, and these are shown shielded in the circuit. To prevent short circuits with other components, such leads should be insulated with a suitable size of plastic tubing.

Where an aluminium chassis is used, as in our case, earth returns may be made directly to it but in the case of a steel chassis all earth points should be connected together with 16-gauge tinned copper wire.

SPACE CONSERVATION

Some midget components were used in the original and these assist materially in the layout. In particular the new midget 25 mfd electrolytics save a lot of space, while midget paper capacitors also make things a lot easier. There is no reason why any of the standard sizes used in the original should not be changed to these if desired.

The "RF-AF" changeover switch and the speaker "on-off" switch are both single-pole, two-position toggle



This detail diagram shows how the germanium diode and load resistor are assembled in the test prod. The grub screw appears to be the best method of preventing strain being applied to these components.

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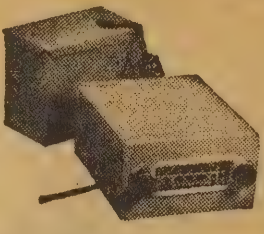
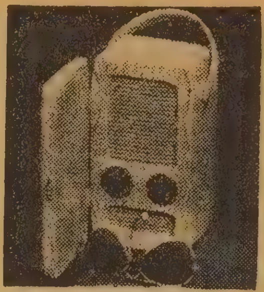
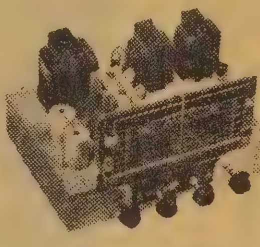
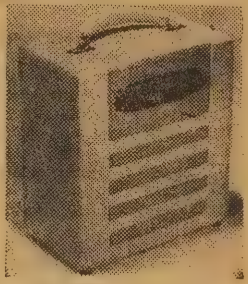

KAR-SET


CARRY SET


1952 ADVANCE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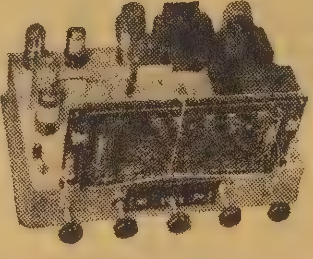
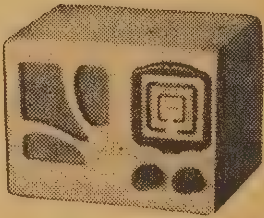

1950 RADIOGRAM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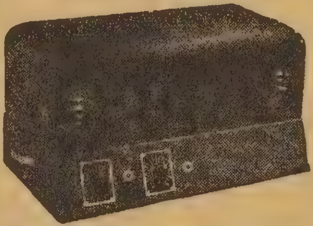
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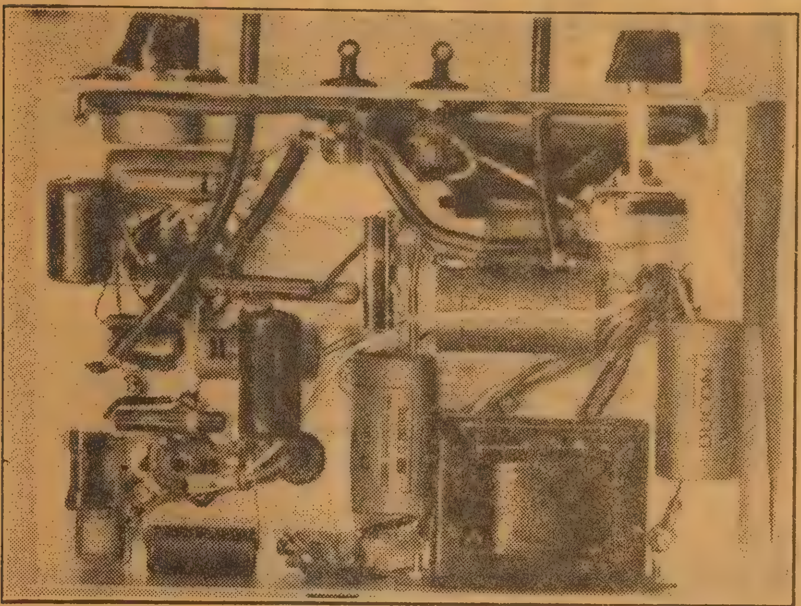
VIEW UNDERNEATH THE CHASSIS



An excellent idea of the wiring can be obtained from this under chassis view. The RF lead is on the left and the ECC35 socket is underneath it. Below it is the 6BV7 socket while the 6X4 is near the right hand edge. Note the AF volume control set back from the panel on a small bracket.

switches, though it would be possible to substitute the simple rotary type with, perhaps, some modification to the panel layout.

While on the subject of the panel we would strongly recommend that you follow our example and have it suitably engraved, a job which a local engraving firm did for us in a few hours and at a very reasonable cost. This not only adds to the appearance of the unit but is essential if one is not to waste time trying to remember the various switch and control positions.

CHASSIS LAYOUT

A good idea of the layout can be obtained from the photographs, particularly as there are not a great number of components, and anyone who has ever made a simple set should have no difficulty in duplicating our original model.

The only point which caused any trouble in the original layout was the location of the coupling condenser to the output meter terminals. We originally mounted this near the 6BV7 socket but found that, with its associated wiring, it provided sufficient coupling to the grid of this valve to cause feedback.

This was overcome by mounting the condenser above the chassis near the output meter terminals and bringing the lead from the plate of the 6BV7 through the chassis via the hole used for the output transformer leads. With this arrangement there was no sign of instability.

The cable for the two probes caused us some thought. It requires to be shielded, for obvious reasons, but it also needs to have an insulated outer coating, otherwise it can easily cause serious shorts when it is draped cross a receiver chassis. Other requirements are reasonable flexibility and a minimum capacitance between the conductor and shield.

Something to fulfil all these requirements does not seem to be readily available but the nearest approach appears to be the 72 ohm coaxial cable known as PT1M. This satisfies most requirements but is not really intended for use as a flexible lead, having only a single-strand conductor which would soon break if subject to continual sharp bending.

Fortunately the thickness of the rest of the cable is such that it is not easy to bend sharply and it will probably be quite satisfactory providing it is handled with reasonable care and not subject to unnecessary kinking or bending.

CABLE FOR PROBES

Most likely trouble spots are where it is terminated and precautions must be taken to eliminate any chance of strain or twist. Both leads were terminted at a tag strip, the outer shield being soldered to an earth tag and the centre conductor to an adjacent terminal. To avoid any risk of twisting, the strands of the shield should be unravelled (not cut) and the loose strands then twisted tightly together. This should be cut off as close as possible to the body of the cable and then soldered to the earth tag. By this means the cable will be firmly anchored and unable to twist.

To avoid strain on the tag strip a short length of 18-gauge tinned copper wire should be wound around the cable so that it presses against the rear of the panel while there is still a small amount of slack in the cable. About two turns of wire

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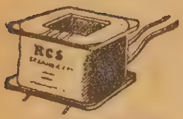
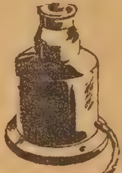
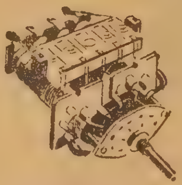


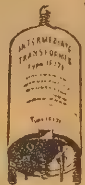
Filter choke.



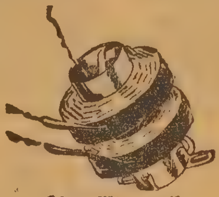
Line filter.



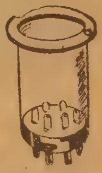
Dual-wave units.



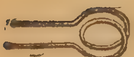
Standard 455—K.C. Intermediate transformer.



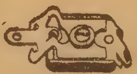
Line filter coil.



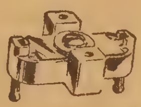
Coil former.



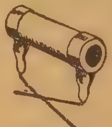
F.M. Coil.



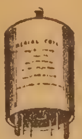
Trimming condenser.



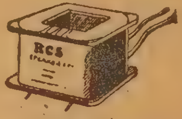
Padding condenser.



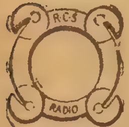
Resistors.



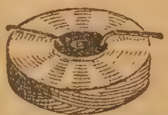
Standard broadcast coil.



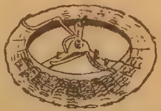
Speaker transformer replacement coil.



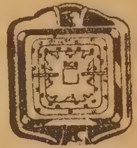
Transposition block.



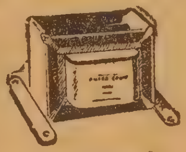
Radio frequency choke.



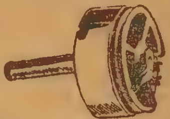
Loop aerial coil.



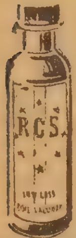
DA7 dial.



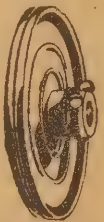
Filament transformer.



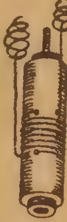
Potentiometer.



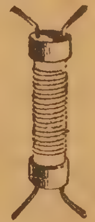
Low loss coil lacquer.



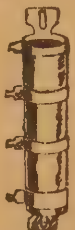
Dial drive drum.



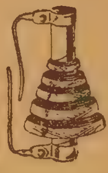
Short-wave Coil.



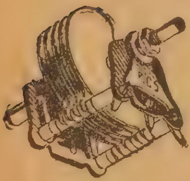
5 band coil.



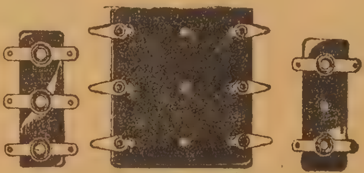
Voltage divider.



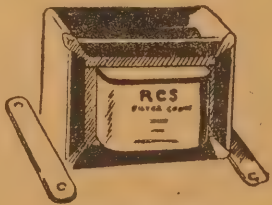
Radio Frequency Choke.



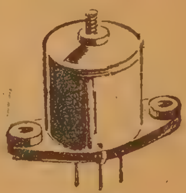
Midget variable condenser.



Resistance strip.



Audio transformer.



Midget Magnasonic Coil

R.C.S. RADIO PTY. LTD., 651 FOREST RD., BEXLEY, NSW.

around the cable are sufficient and if the two ends are then twisted together for a few inches this may be anchored at some convenient point as a further precaution against twisting.

The test prods were specially selected for their large bore, approximately a quarter inch in diameter, and it is essential that a similar type be used in order that the diode and its load resistor may be accommodated. Then length of the bore is 2¼in and since there is not a great deal to spare a slightly longer prod would be desirable.

DETAIL OF PROBE

The method of assembling the components to fit in the prod is shown in the diagram but a few additional points are worth noting.

When the assembly is made up and attached to the shielded cable it should be possible to insert it in the prod far enough to allow the prod tip to be soldered to the length of hook-up wire protruding from the other end. At the same time this piece of hook-up wire must be kept as short as possible to permit a reasonable length of shielded cable to remain inside the prod when the prod tip is screwed into place.

To make this easier we found it best to cut off about one quarter inch of the thread of the prod tip, which still leaves sufficient thread for the job.

The coupling capacitor between the prod tip and the diode consists of two pieces of plastic hook-up wire tightly twisted for approximately one inch and has a value between one and one and a half pf. The wire is a thin walled variety and is classified as 7/.010 P.V.C. insulated equipment wire.

It it just as important to avoid twisting the cable at this end as at the other and one solution to the problem, which presented itself quite by accident, is to make the blob of solder on the shielded braid large enough to make the cable a tight push fit in the prod. When the prod is being screwed onto the tip it will be necessary to hold both the tip and the cable stationary while the prod is rotated, and an extra pair of hands will be a help.

HOLDING DEVICE

Another suggestion is to tap a 5/32 inch hole through the prod wall at the upper end and insert a short grub screw, such as used in knobs, so that it presses against and anchors the cable. If a small piece of metal, such as .01in shim brass, is forced between the cable and the grub screw it will help to distribute the pressure more evenly. A few drops of acetone cement on the grub screw will prevent it from working loose.

The audio prod is a simpler proposition, since no components are housed within it and it is only necessary to connect the centre conductor directly to the prod tip. However, the same precautions about strain and twist will need to be observed.

While signal tracers are usually associated with intermittent and other tricky faults it is a mistake to imagine that this is their sole purpose in life.

Certainly they are extremely valuable in tracking down "out of the ordinary" troubles, but they are also very useful in locating the ordinary everyday faults which comprise the great majority of radio troubles. There is no suggestion that these faults cannot be found by other means but the point is that the "other means" may take very much longer, simply because a lot of unnecessary testing may be done before the faulty component is located.

By establishing in which part of a set the signals cease, the signal tracer will quickly pin-point the faulty stage and reduce the number of suspect components to a small fraction of what it might otherwise be. Once the habit of using the tracer is established the location of a faulty stage seldom takes much longer than is necessary to identify the various stages of the receiver.

Also, by using it regularly, the owner will gain valuable experience in its use as well as the performance to be expected from various types of sets when tested with it. Such experience is invaluable when a really tricky fault occurs.

When in use, it is essential that the chassis of the tracer and the chassis of the set be connected together, and there are a number of ways of arranging this. The chassis of the tracer should normally be earthed through the third wire of the power cable and a convenient scheme is to have an earth wire attached to this point and which can be connected to any chassis under test.

In the case of AC sets there will normally be enough capacitive coupling to the mains to enable the tracer to work satisfactorily at radio and intermediate frequencies without a direct earth connection but this is not sufficient for audio frequencies, and it is best to make the earth connection as a matter of course.

SERVICE ROUTINE

When servicing a set which is, for example, completely dead the procedure would be somewhat as follows: First give the set a quick visual check for obvious faults, such as damaged components, signs of overheating etc., then connect a meter to the HT line and switch on. If the HT voltage is abnormally high or low the fault can probably be located quickly by means of the multimeter and, in fact, it is important that is done before additional damage is done to expensive components.

However, if the HT voltage is normal but the set is dead it should be connected to either an aerial or a signal generator and the tracer brought into operation. With the RF control fully advanced and the RF probe on the grid of the converter it should be possible to tune in any reasonably strong signal. Failure at this point is unlikely but, if it did

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3—Padder.
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6=B+

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Primary "L" — 11 uh.

Secondary "L"—116 uh. when signal tuned to 1000 Kcs.

Recommended Padder for 455 Kc IF's—430 uufd.

Obtainable Grid Current: .25mA, 1600Kcs.
.30 mA, 520 Kcs.

REMARKS

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Tuning Capacity—25—445 uufd. (inc. strays).

Physical Size—1 3-8in diam. x 2¼in.

Pin Connections
1=Osc. Grid.
3=Earth.
6=Cathode.

Mounting—2 x 1-8in holes, 1 3-8in apart.

Recommended Padder for 455 Kc IF's—430 uufd.

Obtainable Grid Current: .35 mA, 520 Kcs.
.35 mA, 1600 Kcs.

REMARKS

A tapped type coil for use with the above converters, optimum results are sometimes difficult to obtain and the user is advised to study the articles in Radiotronics 95 and 120 where the problems are discussed at length.

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Tuning Capacity—25—445 uufd (inc. strays).

Physical Size—1 3-8in x 2¼in high.

Pin Connections
1=Osc. Grid.
3=Padder.
4=Osc. Plate.
6=B+

Mounting—2 x 1-8in holes, 1 3-8in apart.

Primary "L"—5.6 uh

Secondary "L"—116 uh. when signal tuned to 1000 Kcs.

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SIMILAR TO O9 BUT FOR 1600—1900 KC IF's.

Freq. Coverage—520-1600 Kcs.

Tuning Capacity—25—445 uufd. (inc. strays).

Physical Size—1 3-8in diam. x 2¼in high.

Pin Connections
1=Osc. Grid.
2=Earth.
3=Padder. (No connection)
4=Osc. Plate.
6=B+

Mounting—2 x 1-8in holes 1 3-8in apart.

Primary—**"L"**—10 uH.

Secondary "L"—53 uH. when signal tuned to 1000 Kcs.

PADDER: A padder of 80 uufd. is inbuilt between pins 2 and 3. It is recommended that 3—30 uufd trimmer be placed in parallel with this for accurate aligning for 1900 Kc IF's and a further 50 uufd fixed condenser for 1600 Kc IF's. For alignment use variable padder for low freq. end, osc. core for middle freq. and osc. trimmer for high end.

Grid current .125—.400 mA over band.

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Here's your answer, Tom!

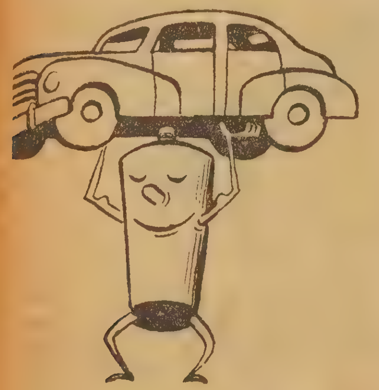
ur boy protege, Tom, certainly keeps us on our toes with his never-nding search for information. Again this month "Tom" is actually several fferent persons and his queries run from torch batteries to trans-rmers while, in one case, he asks how he should go about becoming a radio engineer.

ere is his first question: —

Vhere does the electricity in a ch battery come from?

side the battery, Tom, are a ber of chemicals which, when ed in contact, generate an elec- charge. If a wire or a torch, e is placed across the terminals he battery, an electric current flow, due to the presence of the tric charge. As soon as the ent starts to flow, a chemical on takes place and the original nicals are changed to another n.

ventually a stage is reached when e are none of the original che-als left. Of course, the cell can no longer deliver electric cur-



n the case of an ordinary dry there is very little that can be ie after that. Frankly, most of schemes for charging dry bat-ies are successful only in a very ior way. In other words, the ctrical energy comes from the micals.

By the way, Tom, although many ple are in the habit of speaking a single cell as a battery, strictly s term should be applied to a nbination of cells only. Thus, you uld speak of a 1.5 volt cell in one e and a 45-volt battery in the ier. The latter would be made of 30 1.5-volt cells.

in an ordinary 1.5-volt cell of the e you buy to refill your torch, chemicals are ammonium chloride d the zinc which forms the case the cell.

When current is taken from the l the ammonium chloride reacts th the zinc to form another chemi- called zinc chloride. At the ne time the gases hydrogen and monia are generated. These gases a nuisance in several ways. The most serious thing about them is that they form bubbles around one of the electrodes of the cell and, being non-conductors of electricity, prevent electric current flowing.

Much of the space inside the cell is taken up with another chemical called manganese dioxide, which has the property of combining chemically with the gas to form water and so allowing the cell to operate.

MIXED WITH CARBON

Unfortunately, the manganese dioxide is not a particularly good conductor of electricity either, so that in a practical cell it is mixed with powdered carbon.

In the case of commercial dry cells it isn't even as simple as that because manufacturers have discovered many little chemical "tricks" which help to make the cell reliable and able to deliver a large amount of electricity.

They can design a cell which will maintain its potential over a long period of time when left unused or another type which will give a greater quantity of electricity, but which must be used within a certain time for best results. The former would be useful in the case of a bias battery while the latter would be a better proposition for a torch. It pays to choose a battery designed for the task you have in mind.

It is estimated that an ordinary torch cell generates sufficient energy during a normal lifetime to lift a motor car weighing one ton a distance of four feet from the ground. Certainly, a mighty atom!

In HF, VHF and UHF gear, why is it that hook-up wire must be kept as short as possible?

Every piece of wire, no matter how short, has the property of inductance. In many cases in radio equipment we require large values in inductance and in the case of such items as power transformers, filter chokes and even tuning coils we wind a long length of wire into the form of a coil in order to get the necessary value. Often an iron core is added, because it has the effect of increasing the value of the inductance.

In fact, iron cores are invariably used for equipment operating at power mains frequencies in order to get a worthwhile value of inductance, because the reactance (reactance is a special sort of resistance) becomes lower as the frequency is decreased.

However, the problem is just the opposite when you come to deal with high frequencies. A few inches of wire may have a very high reactance and upset the operation of the equipment considerably. The solution is to make the wires as short as possible.

Fantastic as it may seem, as the frequency is increased, a stage is eventually reached where the shortest possible piece of wire has an inductance too high to be tolerated and the only way to make circuits capable of working efficiently is to build them into the valves. In other words, the connecting leads are eliminated!

Long connecting leads are likely to have a higher value of capacity in relation to other wires and components of the equipment than short leads. Stray capacities become of increasing significance with increasing frequency in the same way as stray inductance, which is a further reason for keeping leads short and direct.

I would like to make a small, economical radio transmitting and receiving set. Would you please send me the plans or put them in Radio and Hobbies?

We have had letters from other "Toms" at various times asking the

same question, and the subject has actually been dealt with before in these pages, but since it is of very great importance we will go over it again.

Before you can operate any transmitter, no matter how small, how low its power or otherwise insignificant it may appear, it is necessary to have a licence. In order to obtain a licence it is necessary to prove to the appropriate authority (in Australia this is the PMG's Department) that you are capable of operating the transmitter in such a way that it will not interfere with other services.

It isn't just that somebody is trying to be difficult or spoil your fun, but radio is now a vital part of certain essential services to the community and your "innocent" experimenting could easily have very serious results.

Just imagine what would happen if your transmitter happened to land on a frequency assigned to an aircraft communication channel. In certain circumstances clear split-second communication is essential. You may be responsible for a serious accident, just because you are selfish enough to want to use radio to talk to your mate down the street.

MANY SERVICES

Aircraft are by no means the only services involved. Fire brigades, ambulances, police and shipping, all rely on radio communication.

If you are caught, as is very likely to be the case, not only is your equipment likely to be confiscated, but you are likely to find yourself facing charges in court.

Certain frequency bands are set aside for experimenters and when you pass the necessary examination you will be allowed to operate on them. The examination isn't so very hard, because thousands of people have managed to pass it.

A good idea is to join a radio club or an organisation such as the Wireless Institute of Australia. Not only would they be able to help you to pass the examination, but you would meet quite a lot of people with similar interests to yourself.

Why should one set work well on most stations without being connected to an aerial and/or earth, while another set built to all intents and purposes the same, with same materials, is silent unless attached to an aerial and earth?

That is one we couldn't explain, Tom, unless we had the two sets on hand for test. Possibly there is some difference in one or more of the components which is not obvious to ordinary observation.

Whatever the cause, the set which operates without an aerial and earth is picking up the signals from somewhere. The most likely place is the power mains. As a matter of fact, most mains-operated receivers do pick up a certain amount of signal from the power mains.

High quality communication type receivers include special precautions to prevent signals getting in other than via the aerial terminal, because the power mains are likely to introduce interference from sundry vacuum cleaners, refrigerators, egg beaters, &c.

BOOK ABOUT ATOMS?

Is there a book about atoms and their structure? They seem to come into everything from atom-bombs to radio valves.

Yes, Tom, an excellent booklet called The ABC of the Atom can be obtained from the Director, Dept. of Tutorial Classes, University of Sydney, at a cost of 1/6. It is quite easy to read and should provide you with most of the information you need.

Could you tell me how to become a radio engineer? I am sitting for the Intermediate in November. What are the requirements? If I wanted to go to technical college, is the Leaving Certificate necessary?

(In this case, Tom lives in NSW, but similar conditions apply in other States.)

In order to start a radio engineering course at one of the technical colleges it is necessary to pass the Leaving Certificate or one of several other examinations of a similar standard. It generally takes about five years to complete the radio course, after which time you would be awarded a diploma, which makes you a radio engineer. The course requires a lot of hard study, but is well worth while if you are keen to get on.

If you have the Intermediate Certificate only, it is possible to start a technical college radio trades course of four years' duration, at the end of which time you will be awarded a radio trades certificate. Both the trades course and the diploma course can be done at night, so that you can earn a living while you are studying.

The best person to advise you as to whether you would be good at radio and which of the courses would be the most suitable for you is the vocational guidance officer at your school. Have a word with him or one of your teachers.

MESSAGES ON A RADAR SCREEN

(Continued from page 11)

(illuminated area) is produced the screen of a special Mullard jection Tube. By means of an op system, the light from this raste projected on to the glass wri plate at the top of the unit. In way the glass plate is continuo scanned by a pencil of light.

In the absence of any pictur writing, the light beam pa through the glass plate. If a n is made on the plate, however, s of the light is reflected and disper and is picked up by a photo Electric currents, corresponding the light variations, are in this produced.

These currents are amplified are then used to modulate the b on the "receiving" cathode ray t which, being synchronised with "transmitting" tube, will t "bright" or "dark" in sympathy. this way a visible reproductio the original work is immedia produced.

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Let's Buy An Argument

The subject this month, as you may have expected, is tape recording and, by way of a pleasant change, somebody else is doing all the arguing. In brief, Mr. Thompson has criticised Mr. Thomas' recent article and Mr. Thomas has suitably replied. It's a pity the names are so confusing but at least we've tried to arrange the letters to emphasise the controversial points. Maybe you have a few ideas yourself.

by W. N. Williams

MUST say that the whole public reaction to tape recorders is her amazing. You find all kinds people with them and every second dio enthusiast seems to have made his mind quite definitely that e must build one.

Why, he's not quite sure, except t it would be "kinda handy." d why should we worry . . . it's nething extra and interesting to ite about!

That a tape recorder is fascinating not be denied. It's a natural y" for any audio enthusiast, quite art from its legitimate place in scheme of things. Most of us, seems, are prey to the urge to hear selves as others hear us.

It is interesting, nevertheless, to eculate whether the tape machine ll always be confined (in the home yway) to "rolling your own" re- dings, or whether it will ultimately fed with commercial tapes, sold er the counter like gramophone ords.

One point is certain—namely that the music barons aren't competing with one another to release vast quantities of pre-recorded tape.

Maybe the market isn't big enough yet for the large companies while the small one's can't get around the royalty and copyright difficulties.

But there are other problems, too. Tape is expensive as a medium, even blank on a reel. Add to that the cost of pre-recording and all the overhead of fees, royalties, profits, mark-ups, &c., and the net figure wouldn't look very attractive against a microgroove disc.

On the credit side I must say that I like listening to a good tape. There seems to be an ease, a complete "relaxation" about the reproduction that I seldom experience with a disc. Maybe the elimination of the mechanical linkage does eliminate noticeable distortion or perhaps it's just that the technical part of me can't forget the poor little stylus racing around a tortuous, never-ending track.

I must admit to a strong suspicion that the latter explanation is really the truth, because a good microgroove disc takes a lot of beating.

To get back to safer ground, handling facilities will have to be streamlined quite a deal before tapes can reasonably be delivered to John Citizen.

I cannot help but feel that, in this respect, threading and spooling arrangements are still in the stage equivalent to the old silent films. Remember how the operators used to clip and mark film to suit their own projectors so that, after a few circuits, you had to read quickly to catch the titles and hope, at the end, that there was still some left of the final clinch.

Tape's a bit like that at the moment. You fiddle and fumble through the side of a reel to make it wind, then hope that the music you want starts at this end of the reel and not the one that's a thousand feet away.

A batch of unmarked tape is the most annoying, frustrating thing you'll come across in many a day. You can't write on the tape itself, branding the reels is a snare and delusion, and you have to get by with little cards which must be religiously poked into the reel before you dare put it down.

It's high time somebody came up with color-coded "trailers" which could be attached to reels and clearly indicate "start" and "finish." The said trailers should have a "gluey" tip to stick to the reel hub and a surface that would take ink or soft pencil.

There might be a good argument, too, for one-sided or skeleton reels, easily loaded and used purely for take-up.

I've seen things like this in professional gear but very seldom on the domestic market. It seems that manufacturers are so busy meeting the demand that they can't stop to think of such niceties.

Think of that beautiful little trip on any "common-garden" typewriter which automatically reverses the travel of the ribbon, when you reach the end.

Anyhow, things like that can and doubtless will be organised—just like the standard trailers on modern talkie films. May I suggest the sooner the better!

However, there's one aspect where tape has it all over disc and it might be vitally important for the home music lover. I refer to the possibilities of stereoscopic reproduction.

I've had something to say about this lately in another connection but I doubt whether the existing race of "one-eared" listeners has any real conception of how important stereoscopic reproduction can be. Many of our frustrations with artificial and conglomerate sound, intermodulation and all the rest would conceivably disappear if our two ears could fulfill their proper function.

IN REAL LIFE

Listening a few weeks ago to the Sydney Orchestra in the Great Hall of the University, I was struck particularly by the automatic activity of the ears in the following sound pattern and direction, particularly in a work like Antill's Corroboree.

To date, we've just shrugged our collective shoulders and agreed that it's important but just too hard to arrange. I can only agree that the idea of using twin broadcasting stations and receivers would be unjustified while the idea of twin-track gramophone records and such devices would seem to be impracticable.

But not twin track tape!

How extremely simple it would be to record twin sterophonic tracks on a single tape and copy them on to commercial prints by any of the standard methods.

And how simple, in the domestic machine to arrange twin playback heads to make available both output channels. Add two amplifiers and two speakers and the job would be done with no more difficulty to the user than a single track system.

Would amplifier fans tolerate the expense of twin amplifiers. Of course they would—and love it!

No, not everybody, but the folk who pay up cheerfully for expensive speakers and turntables, who spend two pounds a time on microgroove record and walk out grinning. Audio is their pre-occupation and pleasure.

The Magnacord people in America have demonstrated the simplicity of stereophonic tape and, if I were aiming to hit the market with pre-recorded tapes and gear, I'd look hard and long at the stereophonic angle. It's good to be able to offer a facility that a rival system cannot duplicate.

PICKUPS AND ALL THAT!

Several readers have written suggesting that the pickup referred to by Messrs. Page and Fields is, indeed, a good one and capable of excellent results. With this I agree, but the position remains that it can minimise but not eliminate distortion and noise inherent in the usual 78 rpm pressing.

Mr. Moyle takes up the discussion in his Review pages, while we have a little to-do about tape!

TAPE—THOMPSON v. THOMAS

Says Mr. Thompson: "I am writing this letter to correct so rather important anomolies in the August issue . . . " To this M Thomas replies: "Some of the criticisms are, to put it mildl remarkable." The arguments are legitimate, however, on bo sides and are worth careful study.

COMPENSATION

The first thing I noticed in Mr. Thomas' article was that he made no mention of pre-emphasis in his block diagram of the recording channel. This was presumably an oversight but it is a misleading omission.

Fig. 1 is a simplified diagram, and such items as frequency correction, level indicator, power supply, &c., were omitted. These matters are dealt with in the text and in later diagrams.

CHOICE OF VALVES

Mr. Thomas mentions that triodes are capable of taking a greater grid swing than pentodes. Is that not rather beside the point? It is plate voltage swing or power output we are concerned with. If the grid swing is going to be too great for a pentode then the circuit has been designed improperly. I am not suggesting that a pentode would be any better but it is a misleading statement. The only time that a triode would be considered for this reason is ahead of the gain control.

To keep distortion to a low level, the grid swing of a voltage pentode must be as low as possible. Triodes are less critical in this respect, and to be preferred ahead of a gain control, if the input level were liable to be uncertain. This does not occur in a mic amplifier, hence a pentode is often used here to obtain a high gain-per-stage.

COMPENSATION

Mr. Thomas suggests that some bass boost is a good idea. We will examine this statement. Suppose the turnover frequency is 8 Kc as it is at 15"/sec using good heads and tape. Below this frequency the response falls at the rate of 6 db/octave. This results in a drop of 200 times at 40 c.p.c. Thus for a level response at this frequency a boost of this much or 46 db is required, assuming level recording characteristic. Your contributor's 10 or 15 db would get him down to about 2 kc.

At the high end a boost of some 24 db is required at 8 kc to obtain level response to this frequency at 7½"/sec.

To use 46 db of bass boost in the record amplifier is not the best way to level the response, since there would be a risk of either overloading the tape with the lower frequencies, or bringing the frequencies around 8 kc/s too close to the noise level, unless the equipment were very carefully designed.

In such a case as this, the better solution to the problem would be to provide a boost of, say, 30db in the record amplifier, and the remainder in the playback amplifier to level the response.

This figure, however, is relative to 8 kc/s, whereas the 10 to 15 db was the amount by which the linear amplification of the record channel should be raised to allow for boosting — a different thing altogether. Thus in the example just given response at 8 kc/s could be 20 below the response at this freque without correction.

HEAD IMPEDANCE

Mr. Thomas is under the imp sion that the bass response is in s way affected by the inductanc the playback head. This inducti has no effect other than to go the output voltage.

The paragraph referring to playback head inductance in rela to bass response certainly might misleading unless the elemen principles are understood. It is the inductance in itself which termines the bass response; but a low inductance playback head, no step-up transformer though signal to noise ratio of the mi and high frequencies may be a quate, the lower frequencies will completely lost without boosting.

However, if the inductance of head is high, the signal to n ratio at lower frequencies will much better, and for speech cording, such as a dictaphone, i perfectly practicable to use no boost at all. Naturally this wo not be suitable for music.

LEVEL INDICATOR

The author appears to think the pre-emphasis used in record should be removed before the sig enters the level indicator. It is instantaneous magnetisation of particles in the tape which conce us and it is this that should checked with the level indicator ensure that its value does not re the saturation level.

If a flute and a piccolo are be recorded together and their nor levels, as picked up by the mic, equal, the correction circuit (fo low tape speed) will raise the le of the piccolo, which has the hig frequency, several dbs above that the flute.

With a linear level indicator, piccolo level will determine the s ting of the gain control. Due to recording characteristics, in the production the piccolo will be at same level as the flute, as in original.

Now, if the piccolo passage er while the flute continues at the sa level, the level shown on the indica will appear to have dropped, a the operator may be misled into ra ing the gain. The reproduced flu notes would then be disproportiona loud, spoiling the artistic effect co pletely.

If the level indicator has a dec rection circuit, as described in t text, it will indicate what the le will be on reproduction, regardle of frequency. There will be question of overloading the tape the procedure described is followe

BIAS FREQUENCY

Contrary to what Mr. Thom states, the bias frequency is qui

(Continued on Page 43) ☞

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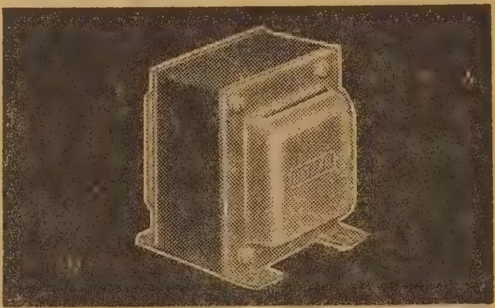

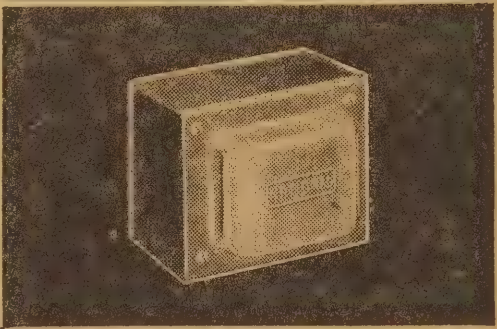

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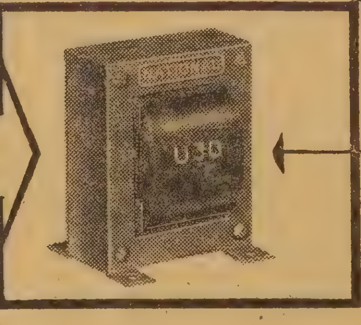

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important. The higher frequency biases (around 60-100 kc) while slightly more difficult to handle, enormously improve the frequency response and high frequency distortion. Under certain conditions it is impossible to record frequencies above 5 kc as pure sine waves without getting odd frequency heterodynes if a low frequency (30 kc) bias is used.

The exact bias frequency is not critical in itself. The higher the frequency, obviously, the better the waveform at high audio frequencies; but for general-purpose or amateur recording 30 kc/s is sufficient. It becomes difficult, as Mr. Thompson suggests, to obtain sufficient current in the head as the frequency is increased, though some professional recorders use frequencies as high as 100 kc/s, with superlative results.

P.M. ERASE

The proposition that a permanent magnet be used to erase portions of a recorded tape is preposterous unless an enormous hiss level is permissible. To have a voice cut out and be substituted by a loud hiss is most annoying. A more satisfactory method of removing such a sound is to switch to the "record" position for the length of erasure required.

Another reason for keeping magnets away from the recorder is the danger of magnetising the playback head. This has very serious repercussions.

It is not likely that permanent magnet would be used to erase a portion of a tape in professional work, but experimenters can and do find this practice convenient at times. Provided that the tape is completely saturated the hiss level is not objectionable. Long unwanted sections can be eliminated with scissors or by passing the tape under the erase head.

It is of course necessary to avoid touching the playback head with the magnet, as this might leave a residual magnetism in the core.

BIAS WAVE-FORM

There was some mention of bias waveform without giving any reasons.

The necessity for a pure bias waveform is a matter of basic theory. Even harmonics, which are most readily produced, cause distortion of the A.F. waveform.

The theory of magnetic recording has been thoroughly dealt with in previous articles in Radio and Hobbies.

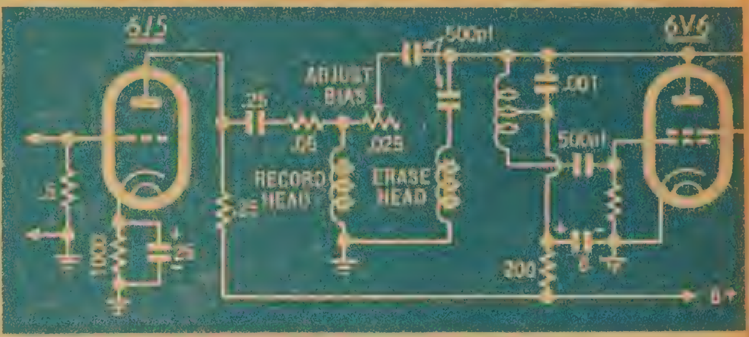
HEAD INDUCTANCE

Mr. Thomas states that best results can be obtained using low impedance recording heads. This is quite untrue. The medium impedance types give the best results and even with these, unless special expensive circuits are used to feed them, they are no better than high impedance types.

There is no such statement in the article. The reference to low or medium-impedance windings deals with the coupling between the oscillator coil and the head, and a preference is expressed for such a separate winding for the bias current to minimise interaction between bias and AF circuits.

Where a head has a low-impedance bias winding, the AF winding is usually high-impedance and this would be capacitance coupled to the output stage, through a resistor to give a constant-current output.

SINGLE WINDING CONNECTION



Illustrating a point in Mr. Thomas' argument—how a head with a single winc can be coupled to both audio and bias sources, the latter adjustable to suit the h and tape.

Also an illustration is given of how a low-impedance head could be connected to both bias and AF supplies.

LOW IMPEDANCE

The difficulty with low impedance heads are: 1. The waveform from the secondary of an oscillator coil is often very distorted. 2. If an ordinary speaker transformer is used the following difficulies will arise:

(a) The head will not load the output valves properly.

(b) Double the frequency discrimination will be caused, which can be quite serious with the type fitted to speakers.

3. If the head is used for playback it will require:

(a) A step up transformer at great additional cost and hum troubles.

(b) A second winding. This is most undesirable since, as in most designs, the record winding is placed at one end of the head in a small space. This uses the field of the recording head to tend to point straight out instead of curving with the pole pieces giving a very fuzzy gap and a tendency to erase the high frequencies as it records.

The objections to the use of low-impedance recording heads are valid where professional equipment is being considered, but for experimental or amateur recorders they have some advantages. They are easy to wind, and high working bias voltages are avoided.

But in spite of the theoretical objections to a single low-impedance winding, the author has used the circuit of Fig. 7 to give quite acceptable results. It would not be used where high-fidelity is the primary consideration, owing to the lack of bass. Since the power required for recording is measured in milliwatts, the mismatch is not as serious as it would appear.

The objections to the use of a low-impedance playback head are misleading. Reputable makes of mic transformers give no trouble with hum pickup. Naturally, this component must be screened; and it would be foolish to mount it above a power transformer.

It is correct to wind the coils one above the other, not side by side, so there is no objection to having two sets of windings except possibly lack of space.

RECORDING POWER

Some doubt seems to exist re ing the power requirements fo cording. A properly designed takes about or less than 10- watts peak.

As Mr. Thompson says, a 10mw. is a typical level for a designed head. Where the cou introduces losses or the head is efficient, more may be required exact level can be stipulated. F ever, the amplifier should be ca of supplying at least 10 db. output than the maximum level quired "on load," in the interes quality.

LOAD PROBLEMS

A recording head is an indu The magnetic density across the depends on the current flo through the winding, neglecting lo The voltage appearing across head is proportional to frequenc constant magnetic fields. These as stated are fundamentals.

To cite a typical commercial h it has a reactance of about 2000 o at 1Kc, i.e. 100 ohms at 50 c.p.s. 20,000 ohms at 10Kc. We now tur Mr. Thomas' circuit and what do see? Just that same reactor conne to the plate of a small triode w is expected to work under those ditions. To make it worse there .25 Mfd capacitor in series with head, far too small a value. would cause the circuit to be fur upset at and below the frequenc resonance of the two reactances. quite obvious beside this that valve, particularly a triode, c operate without enormous distor with an AC to DC load ratio to .500.

The constant-current requiren of a recording head for constant flux at any frequency is a matte basic theory. However, the diffic here arises from Fig. 6, which intended to demonstrate the relati ship between bias and audio circ in the case of a high-impedance h and was therefore considera simplified.

In practice this circuit would clude a "swamp resistor" in se with the head so that the impeda offered to the valve would be m nearly constant. The value of swamp resistor would be typic from 20k. to 100k. The higher inductance, the higher can be swamp resistance, and hence the b

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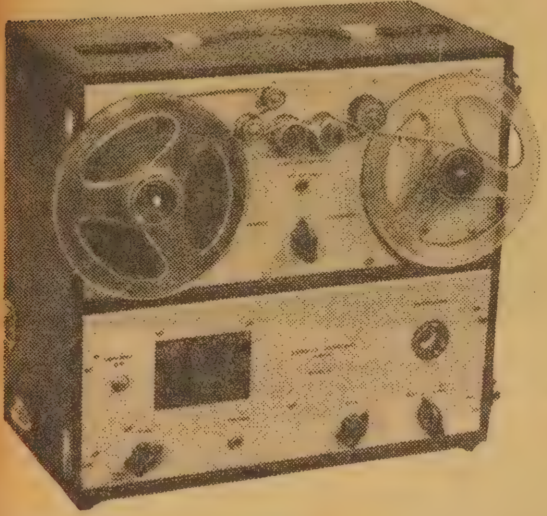

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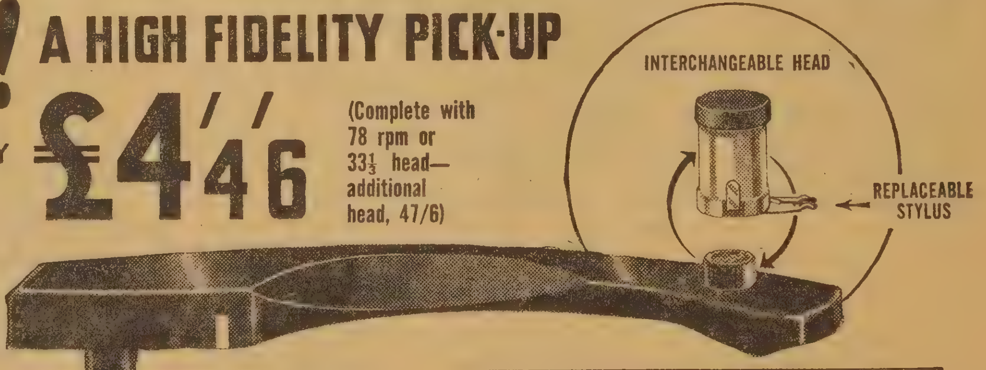

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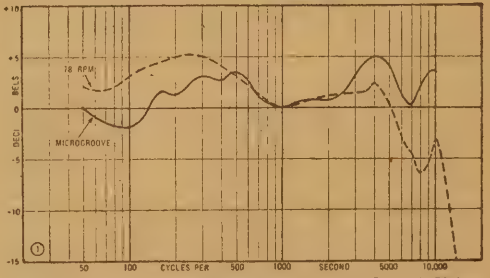

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ter the bass response with any given coupling capacitance.

At 50 c/s, .25 mfd has a reactance Xc of 12,700 ohms. If the load, including swamp resistance, is about 50 k., this gives a drop of about 1 db. at 50 c/s. Without the swamp resistor the loss would obviously be considerable; in fact the valve would be working into a mainly capacitive load of about 10,000 ohms, to say nothing of the effect of the resonance of the head with the coupling capacitor.

An exception to the constant-current principle is transormer coupling. A transformer-coupled head receives, for practical purposes, something approaching a constant-voltage output from a triode, provided large amounts of power are not drawn from the circuit. This means that the head current is higher at low frequencies, and so provides its own bass boost down to a certain point where the reflected impedance is less than the optimum anode load impedance. If a suitable transformer and valve are chosen, this can be quite low.

In Fig. 10, for instance, a triode-connected 6V6 is shown. Strictly, this will only be correctly matched at one frequency, which might be 100c/s. Below this the recording current will fall, and with it the bass response. Above this frequency, the current will again fall, but this is in order since it represents the desired bass boost. At the higher frequencies, the valve is operating more as a voltage amplifier than a power amplifier.

Above the turnover point, the response will again fall unless high-frequency boost is provided. Alternatively, the tape speed might be increased to bring the turnover point nearer to the desired upper limit.

Certainly the arrangement is not ideal, but it is simple and it works. Naturally if a high-impedance head is available, the experimenter would use capacitance coupling.

BIAS ON PLATE

There is also the matter of allowing the bias voltage to appear on the plate of the recording valve. This voltage is in the vicinity of 100 or more, R.M.S. or about 300v peak to peak. This is far more than is necessary to cause severe non-linearity in the valve and so very large distortion does occur. In fact wave peak clipping occurs.

The effect of bias voltage appearing on the plate of the AF valve is dealt with in the text, and possible steps to avoid this are mentioned. The aim should be to use the smallest bias voltage which will give linearity, and in practice it is possible to use about 20 — 30 volts of bias, as measured across the head, which is very easily filtered from the AF stage If the head inductance is very high, of course, more than this will be required.

IN CONCLUSION

Well thank you Messrs. Thompson and Thomas for some interesting discussion. Doubtless, there'll be more to follow about the amplifier featured in the last issue, because it includes some of the points which are at present the subject of discussion.

But what's it matter? We're all learning in the meantime and my prevailing conviction is, indeed, that we all have a lot to learn still about how to handle tape mechanically and get the best out of it electrically.

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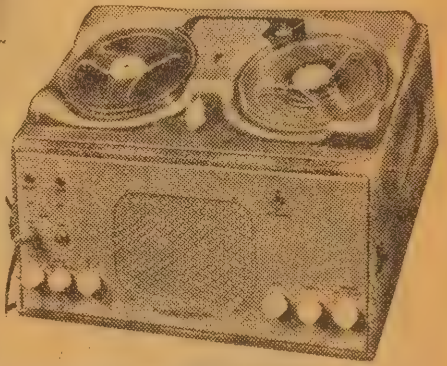

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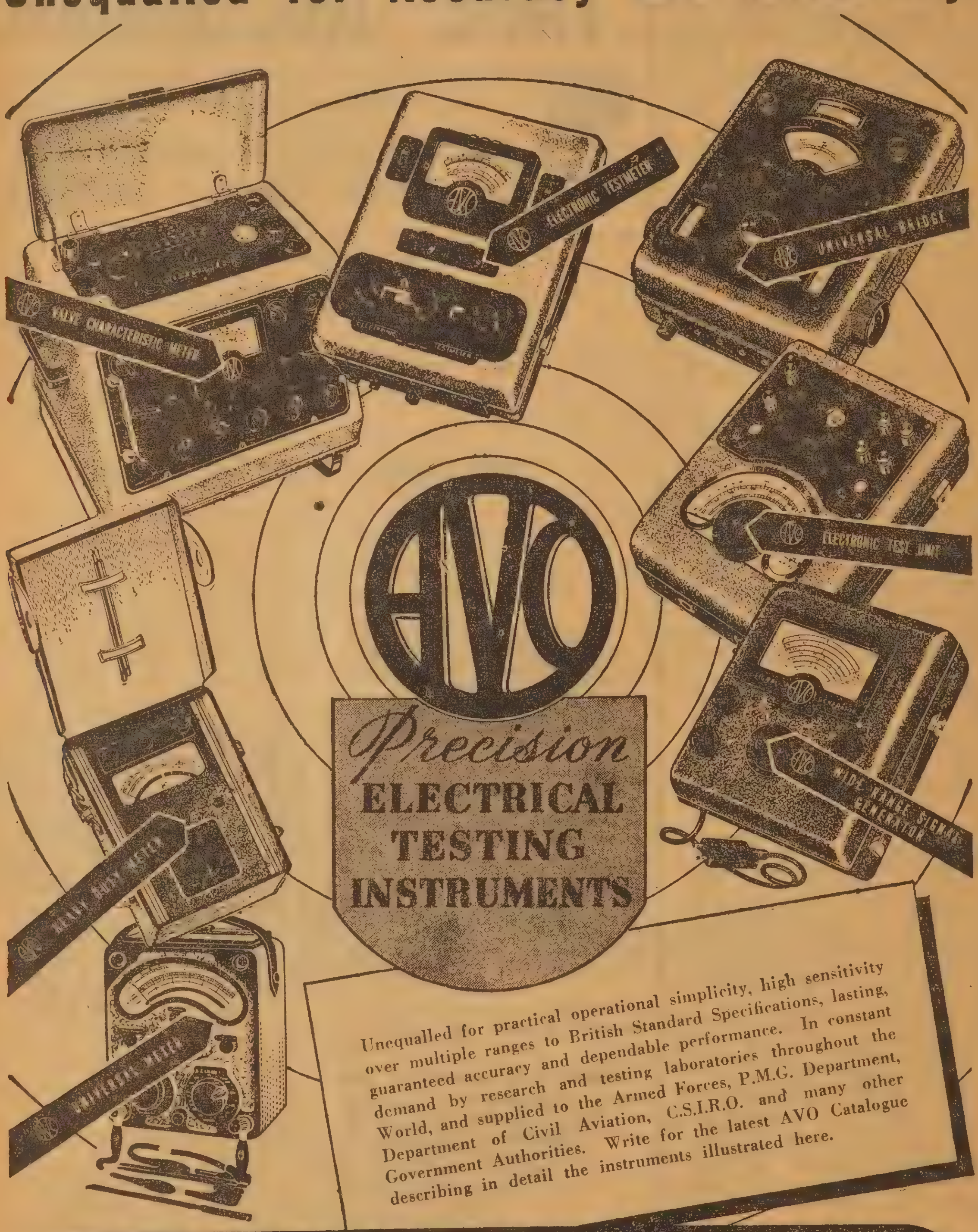

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FROM THE SERVICEMAN WHO TELLS

To think of unstable sets is naturally to think of the RF and IF section. However, that such is not always the case is shown in one of the following cases. There is also an unusual interference problem contributed by a reader, while I personally indulge in the luxury of a real good "winge."

YES, before dealing with matters technical this month, I want to air a grievance I have been nursing for a long time. This concerns what appears to be the now almost universal habit, by repair departments in general and servicemen in particular, of whisking a faulty device out of the hands of the customer, giving him a receipt and a date on which to call, but never making the slightest effort to discover WHY he brought the device in for service.

BOTH UPSET!

Likewise, very few customers can express the trouble clearly and the final result is complete dissatisfaction all round. The customer is firmly convinced he has been "done," and the repair man is equally convinced that the customer is miserly and hard to get on with. No wonder that each often regards the other as the lowest form of life!

The system on which such departments operate is that of completely overhauling the device and restoring it, as nearly as possible, to new condition. In many ways this is a commendable approach but it can be a risky one if it is not tempered with some idea of the customer's requirements.

The two main risks, as I see it, are these: Firstly, there is the possibility that a complete overhaul is a much bigger job than the customer considers necessary or is prepared to pay for and that the job he really wanted done was a comparatively minor one.

In these circumstances he feels that a very simple job has cost a great deal more than it should and will often take a lot of convincing that the other work was really necessary. After all, he hadn't noticed that these things wanted doing. Result: He is convinced he has been "got at."

A MULTIMETER

As an example, let me quote an actual case. A colleague had the misfortune to drop a pair of cutters on his multimeter, cracking the meter glass but otherwise, apparently, doing no serious damage. He returned it to the makers and, because the fault appeared so obvious, neglected to specify what was to be done.

Some time later he was advised that the meter was ready but was staggered to learn that the account was nearly £4. When he questioned such a charge for replacing a meter glass he was informed that the instrument had also been completely overhauled, several voltage ranges adjusted to original accuracy, the meter and shunts checked, &c., and that, considering the cost of labor, this was quite a reasonable charge.

On this basis my colleague was forced to agree that the charge was reasonable, but the point was that he hadn't wanted all that work done. The instrument was used only for rough "cart around" work and he was quite satisfied with the performance of the meter up until the time of the accident.

The firm appreciated that there had been a misunderstanding and made a reasonable reduction in the account, though it was still much more than the charge for fitting a new glass. Thus the whole transaction could only be regarded as most unsatisfactory from everyone's point of view.

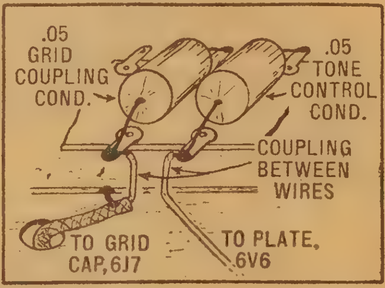
And who was to blame?

BOTH TO BLAME

Personally I feel that both parties contributed, the owner for not specifying exactly what work he wanted done and the firm for not insisting that such information be supplied before the job was started.

The second risk, and this applies particularly to the radio serviceman, is that of overlooking the very fault which has been causing the customer trouble and which caused him to bring the set in for service.

One example of this is the intermittent fault and I have had numerous cases quoted to me where sets which have supposedly been serviced for this fault have been returned with it just as much in evidence as before. In some cases this may be due to technical incompetence but, for the most part, it is due simply to the fact that the technician has no idea that such a fault is supposed to exist.



One case where the use of a tag strip made the layout neater but upset performance. For the reason, see the circuit on the next page.

What happens would be something like this: The customer pushes a chassis across the counter and says, "This set is crook; how soon can you fix it for me?" The serviceman makes a rough calculation based on the number of sets still to be done and tells the customer to call back in a few days' time.

Eventually, he gets around to checking it and finds that it has a certain amount of hum because both electrolytics need replacing; that both dial lamps are out, one being loose in the socket and the other needing replacement; that the dial mechanism is inclined to slip and, as a result, the calibration is wrong; and, finally, that the IF valve is weak and the sensitivity rather lower than it should be.

With all these faults corrected and the usual routine alignment completed the serviceman considers the job well done, the set is delivered to the customer—and the appropriate fee collected. But anyone who has had anything to do with intermittents will know that it is quite normal for them to lie dormant for days, or even weeks, so that it is not surprising that the serviceman completely overlooked it.

From the customer's point of view the set is not a great deal improved. Certainly the hum is gone, but from where he normally sat it didn't bother him much, so that he is scarcely aware of the improvement. The improved sensitivity means precisely nothing, because he only ever listens to the locals, anyway. Of course, it's nice to have the dial alight again and the calibration right, but it's doubtful whether this will offset the fact that the intermittent is still just as bad as ever it was.

REPUTATION SUFFERS

Certainly the serviceman's reputation will suffer, though he may never know anything about it, for it frequently happens that the customer will take the set elsewhere with the story that "So-and-so was supposed to fix this. but is was no better when it came back, even though he charged me enough for the job." Unfortunately, it does not take many such cases to give business a bad name, and all for the want of a few simple inquiries when the set is taken into the shop.

There are also plenty of other faults which need not show up on the service bench at all. Noise and some types of intermittents can be due to faulty house wiring, while many types of interference between stations can be attributed to the location rather than to the set.

Mind you, in many ways my sympathies are with the serviceman, because getting a few simple details out of some people is like trying to raise London on a crystal set—it's well nigh impossible.

In some cases it's just plain cussedness, the reasoning being that the serviceman is being paid to do the job, and therefore the owner should not have to answer a lot of silly questions. Thus, to ask (of the set), "What's wrong with it?" is to stick one's neck out and risk being told, in effect, that that is what you are being paid to find out.

Most people are more considerate, though not necessarily more helpful, because it's amazing the verbal

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SRF-2 Radio Frequency Coil, Iron Clad, Shielded	12/11
SO1 Oscillator Coil, suits 6J8, 6A8, X61M, ECH35	12/6
SO2 Oscillator Coil, suits 6SA7	12/6
SO3 Oscillator Coil, Unshielded, for 6J8, etc.	10/11
SO4 Oscillator Coil, Unshielded for 6SA7	10/11
SIF-1 1st I.F. Transformer (Low gain)	18/3
SIF-2 2nd I.F. Transformer (Low gain)	18/3
SIF-3 1st I.F. Transformer (High gain)	19/11
SIF-4 2nd I.F. Transformer (High gain)	19/11
MA-2 Aerial Coil, Shielded, Iron Clad, Tapped for Capacity Coupling	13/11
MA-3 Aerial Coil, Unshielded, Iron Clad	12/6
MRF-2 R.F. Coil, Shielded, Iron Clad, Tapped for Capacity Coupling	13/11
MO-1 Oscillator Coil, Unshielded, for 1R5, Wound on 1 Meg. Resistor, with Circuit Diagram	6/11
MO-2 Oscillator Coil, Shielded for 1R5	13/3
MO-3 Oscillator Coil, Shielded, for 6AN7/6J8	13/3
MO-4 Oscillator Coil, Shielded for 6BE6	13/3
MO-5 Oscillator Coil, Unshielded, for 6AN7/6J8	10/11
MO-6 Oscillator Coil, Unshielded for 6BE6	10/11
MIF-1 1st I.F. Transformer (High gain)	19/11
MIF-2 2nd I.F. Transformer (High gain)	19/11
LA-1 Loop Aerial, designed for High Gain and Maximum Pick-up; includes loading Coil and Resistor supplied with Circuit Diagram	11/9
RFC-1 Radio Frequency Choke Coil, Single Pye, 2.5mH	3/11
RFC-2 Radio Frequency Choke Coil, 4 even pye	5/10
RFC-3 Radio Frequency Choke Coil, 4 tapered pye	5/10
CS-1 Crystal Set Coil— Former 2". Diam. 2¾" long	5/10
Tapped	3/11
REPLACEMENT WINDINGS FOR OLD TYPE AIR CORE I.F. TRANSFORMERS (465 K.C.)	
AIF-1 1st I.F. Winding	7/9
AIF-2 2nd I.F. Winding	7/9
SHORT WAVE COILS 9/16" DIAM. FORMER	
SWA-1 Aerial Coil, 13-42 Metres	6/11
SWA-2 Aerial Coil, 16-50 Metres	6/11
SWO-1 Oscillator Coil, 6J8, etc., 13-92 Metres	6/11
SWO-2 Oscillator Coil, 6J8, etc., 16-50 Metres	6/11
SWO-3 Oscillator Coil, 6BE6, 13-42 Metres	6/11
SWO-4 Oscillator Coil, 6BE6, 16-50 Metres	6/11

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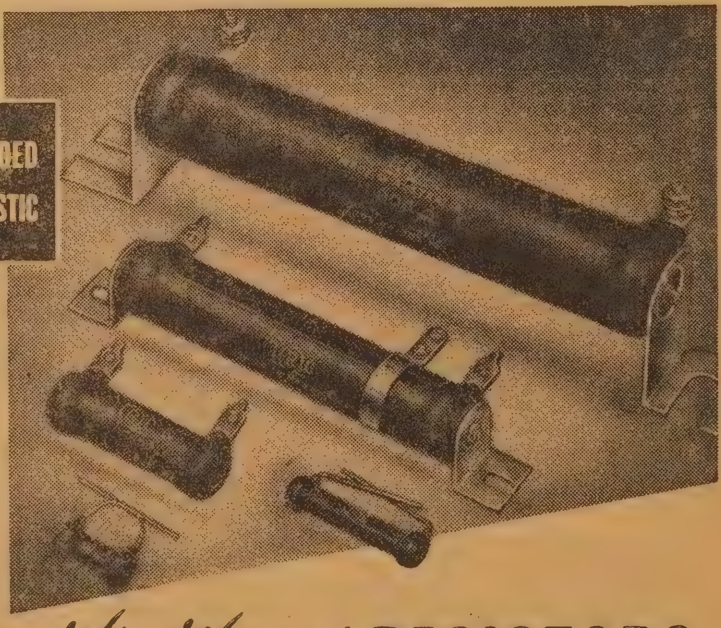

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tangle they can get into when trying to describe the symptoms of a set. To many, any foreign sounds, whether they be hum, oscillation, electrical interference, or sundry crackles from a dry joint, are all listed under the term "static." To others, hum is distortion, and distortion is a buzzing sound, and the circle is made complete by the chap who says a buzzing sound when he means hum.

Dealing with all these types calls for a good deal of tact, but the right approach will usually get results, and, to any aspiring serviceman, I would offer this advice: Always find out all you can about WHY the customer wants the set serviced.

And having got that off my chest, let's get back to technicalities.

RECEIVER TROUBLE

You may remember that a few months back I had occasion to check a home-made receiver built to the Radio and Hobbies "1946 Advance" circuit, and which failed to operate, due to a faulty oscillator coil. Not long after this job I had another home-built receiver to service, which also turned out to be an attempt at this circuit.

In this case, however, it did not look much like the original design, being a conversion job on a very old chassis. It seemed that the original valves (2.5 volt types) had been on their last gasp and, being difficult to replace, the owner had decided that he really needed a new set. On the other hand, he had a particular fondness for the existing cabinet, and the only easy way to retain it was to have a new set built on the existing chassis, retaining the original gang and dial and as many other major components as possible.

Thus it was that the owner enlisted the services of a friend, who had built one or two sets for his own amusement, and suggested that he might be able to bring the chassis up to date. After considering what parts could be retained it was finally decided that the "1946 Advance" circuit would be most suitable, and the necessary valves and parts were duly purchased.

NEW LAYOUT

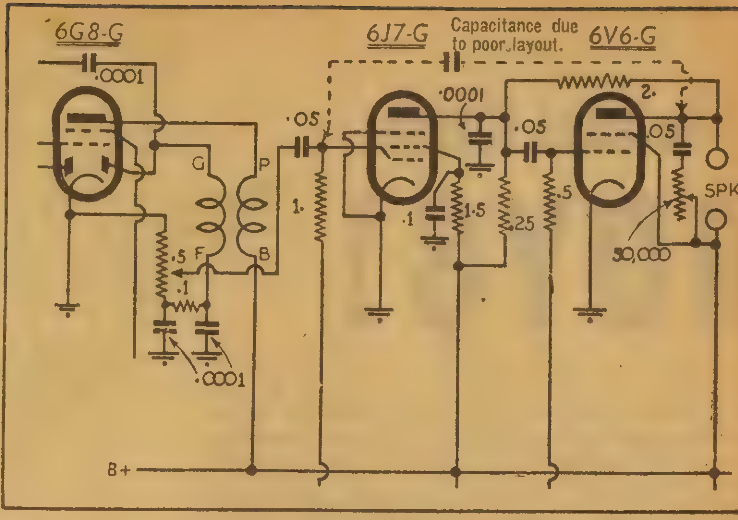
Since the chassis was nothing like the one designed for this circuit it was impossible to follow the original layout, and a new one had to be worked out to suit the altered placing of the valves and other major components. Nevertheless, our home builder could see no reason why the results should not be as good as the original, for he followed the circuit carefully and also observed all the usual layout rules about the placement of grid and plate leads around the IF transformers, &c.

Unfortunately—for him—it didn't turn out that way. Certainly the set worked as soon as it was switched on, but his triumph was short-lived for, realising that the "tone" was a little deep, he advanced the tone-control, which had been set, quite by accident, in the maximum top cut position. As he did so the set gave forth a piercing screech, and nothing he could do would eliminate it until he returned the tone-control to the full cut position.

As he did so, he realised that the tone control was noisy and closer inspection showed that part of the element was badly charred. Since it was one of the potentiometers salvaged from the original set he concluded that it had probably been that way for some time and replaced it with a new one.

Further investigations showed that the volume control had some effect on the oscillation, it being possible to stop it by turning the control right off, the oscillation commencing when it was advanced to about normal operating position, after which the effect was only slight. While this and other tests were being carried out, the builder realised that the tone control had become noisy again and, on checking, found that it had burnt up in a similar manner to the first one.

It was at this stage that he decided to give it best and brought the chassis to me.



Unwise placement of the two .05 mfd. condensers in the "1946 Advance" circuit caused instability in this home-built receiver by coupling the output back to the input of the audio system.

After he had given me the facts which I have related above, I put the set on test. There was no doubt about the oscillation being a violent one, for the screeches it gave forth were most distressing, and I concluded that the power being delivered to the speaker, although badly distorted, was considerable, and probably the reason for the burnt out tone control pot, this being in the plate circuit.

PERHAPS you, as a serviceman, would like to tell us about some incident which was technically intriguing or just plain funny!

Or, as a member of the public, you may have a special complaint against radio servicemen!

Either way, we'd like to hear about it. Address your letter to "Radio & Hobbies," Box 2728C, GPO, Sydney, and we will pass them on to the author of these articles.

Removing the 6G8 valve from its socket had no effect, which more or less confined the trouble to the audio section. There was even the possibility that it might be confined to the 6V6 and that this valve was suffering from self oscillation. On the other hand, this valve is normally a stable type and not nearly so prone to this trouble, even at supersonic frequencies, as are such types as the 807, EL3, 6M5 &c., which are usually fitted with grid stoppers as a matter of course.

Shorting the grid of the 6J7 stopped the oscillation, thereby suggesting that both the audio valves were involved. Closer inspection of the chassis showed that the grid lead of the 6J7 terminated on a tag strip which carried the .05 mfd coupling condenser from the moving arm of the volume control.

From the point where it came through the chassis to a point directly under its terminal, the lead ran against the chassis and then was bent at right angles to reach the terminal which was about three-quarters of an inch above the chassis. The really important point, however, was that this last three-quarters of an inch was not shielded, the braid finishing where the lead left the chassis.

CONDENSER PLACEMENT

The reason why this was important was because the .05 mfd condenser in the tone control circuit was mounted on the tag strip directly alongside the coupling condenser and the lead to it from the plate of the 6V6 ran parallel with the grid wire for the threequarters of an inch between the terminal and the chassis.

Due to the manner in which they were attached to the terminals, the spacing between them was rather less than the distance between terminals, being only about a quarter of an inch.

It seemed rather unlikely that there would be sufficient capacity between these two wires to provide appreciable coupling at audio frequencies, but to make sure I placed the blade of a screwdriver between them while the set was oscillating, earthing it to the chassis. The oscillation ceased immediately and the set appeared quite stable until the tone control was fully advanced.

As a further test I temporarily rearranged the position of the tone control condenser and associated wiring so that it was well away from the grid circuit. Now the set was completely stable and it was only necessary to make the new layout permanent to complete the job.

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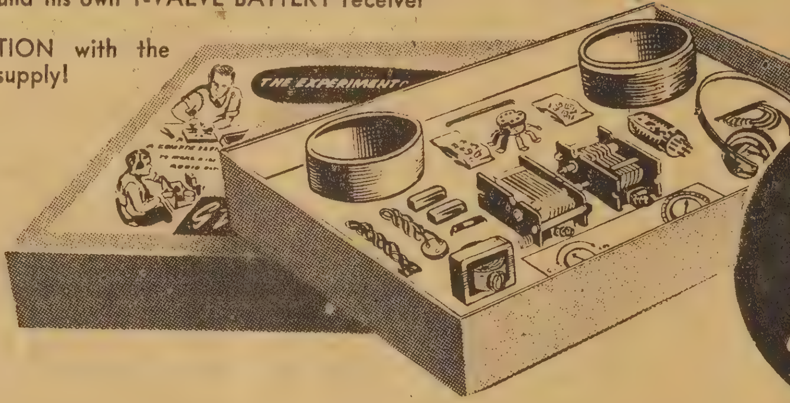

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All of which just goes to show that regeneration problems are not confined to radio and intermediate frequencies, though, admittedly, they become more numerous as the frequencies get higher. In this case the coupling was only serious because it involved two stages and the gain of the 6J7 and 6V6 combined is considerable.

The reason the volume control setting had some effect on the feedback was because, in the "off" position, it was effectively shunting the grid to earth with a condenser—the .05 mfd coupling condenser.

With a new tone control pot. fitted and the alignment adjusted, the set performed extremely well, to the complete satisfaction of all concerned.

FROM A READER

And to finish off this month I am quoting a letter from a reader, and which has been passed on to me by the Technical Editor. It is from Mr. R.F.H., of Artarmon, Sydney, and he writes as follows: "This story started with a request from a friend to thoroughly overhaul a big TRF receiver, which had been designed for faithful reproduction from the local stations and which, until recently, had given complete satisfaction.

"After completely rebuilding the set, mounting most of the components neatly on tag strips and, by suitable placement of the leads, removing a former tendency to oscillate, yet, apart from correcting some obvious faults, leaving the circuit design unaltered, I returned the set to its grateful owner. Unfortunately for my prestige, the set insisted on loudly saying di-di-dit dah-di-dah-dah several times a minute, and this interference in no way responded to the tuning knob.

"A phone call to the PMG's Department gained the information that the dits and dahs were coming in on 380 Kc. The obvious thing was a wave trap, but this was not very successful, since the set had a high impedance primary winding in the aerial transformer. Undoubtedly, a specially designed aerial filter would have done the job, but it seemed more profitable to investigate the possibility that some circuit within the set had been accidentally tuned to resonance with the interfering signal.

PRIMARY RESONANCE

"Exploration with the signal generator showed a marked response near 380 Kc, and some judicious prodding with a 10 pf condenser showed that the unwanted resonance occurred in the anode coils of the two RF transformers. To permanently detune them, a 10 pf condenser was connected across each and, since measurement showed that the gain was not seriously reduced, the set was pronounced cured. My friend has since reported that the code signals have completely disappeared and that the performance of the set is very good."

Thanks, Mr. R.F.H., for a rather interesting and unusual fault. Main point for comment seems to be that the RF coils were rather unusual, since most modern types appear to be designed with a primary resonance somewhere between the end of the broadcast band and the normal IF channel, that is, somewhere around 500 Kc. This is done in an effort to improve the gain at the low frequency end of the band, which otherwise suffers from the reduced coupling at these frequencies.

For this reason sets frequently show a tendency to "take off" at the low frequency end of the band when not connected to an aerial, which normally loads this part of the circuit sufficiently to render it stable.

However, it would still be possible to experience a similar fault with these coils, since there are also many signals around 500 Kc, normally a shipping band, and which would be strong enough to cause trouble, particularly in coastal regions. In any case, regardless of the type of coils used, the TRF enthusiasts might well keep this point in mind if they encounter signals which do not respond to the normal tuning control.

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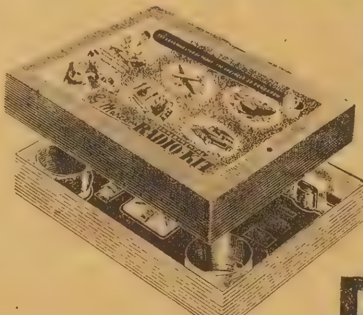

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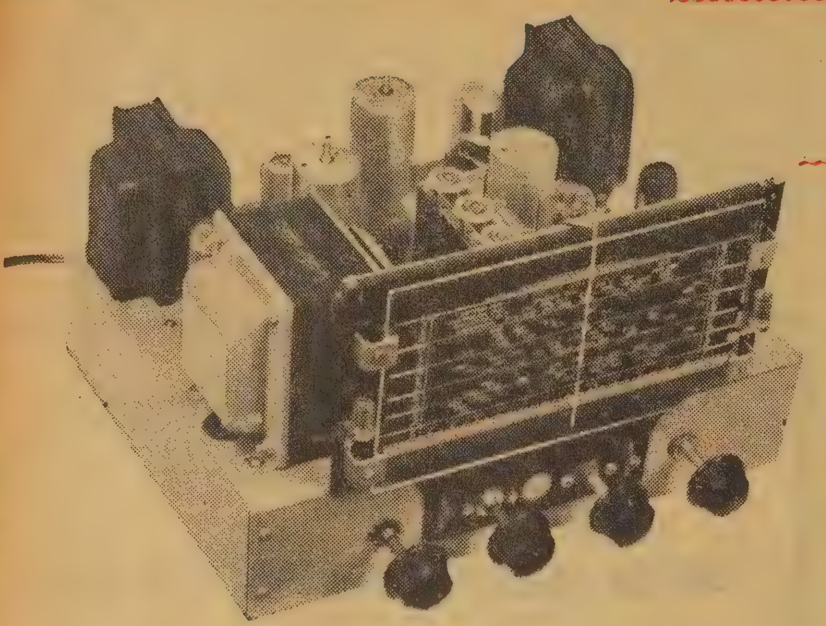

The knobs are from the left—tone, volume, tuning, function switch. Note the mounting of the trimmers atop the gang section. There is sufficient room on the chassis to take any brand of upright mounting power transformer.

THE WIDE-RANGE SIX RECEIVER

At last—a true wide-band radiogram complete on one chassis. Combining our latest superhet wide-band AM tuner with the Playmaster Baby amplifier, our new set will set a standard in general home entertainment for the quality enthusiasts. It employs five valves plus a rectifier and will accommodate all 78 and microgroove recordings.

by Raymond Howe

HERE is a radiogram of which the home constructor really can be proud. There are no constructional or electrical complications. The easily-aligned radio tuning portion gives high fidelity while the "gram" portion suits all current 78 and microgroove pickups.

It all began back in the August issue of this year when we described a true wide-band superhet AM tuner. This tuner tackled the problem of wide-band radio reproduction in an entirely different manner from that employed previously.

WIDE INTEREST

It met with ready response from all quarters, not just because it was a different circuit, but because it could do a better job in a better manner than any other previous design, in terms of wide-band response. It did not sacrifice simplicity, and, what's more, it lost out very little in the matter of sensitivity.

The story is told in the August and September issues. Sufficient to say now that quite a number of wide-range coil kits are becoming available on the market for it.

Although the original design was presented as a tuning unit for an amplifier set-up, the use of the basic idea does not end there. Why not a composite arrangement of the wide-band tuning system and a suitable audio system complete with a power supply, all on the one chassis and ready to fit into a standard radiogram cabinet? Even without a vented enclosure, it must still sound a lot better than an ordinary radiogram.

Quite obviously, this is a logical combination for those who want high quality reproduction on radio as well as from disc, without going to a set-up too ambitious for the pocketbook.

We first applied this idea at the beginning of this year, remember, in the "1952 Advance," in which the original R & H variable selectivity arrangement was combined with the "Playmaster Baby" amplifier of the December, 1951, issue.

That "broad-banding" idea has now been bettered by our present design, but the "Playmaster Baby" amplifier still remains as a simple yet effective means of reproducing microgroove and 78 rpm discs (British and American) in the home.

By mating the Wide-Band Tuner design with the Playmaster Baby amplifier, we feel that we really have something in the way of high quality entertainment for the average home.

Before going further, we would like to point out that, if you are interested in tuning lots of interstate and country stations, you would still be better advised to adopt the design of something like the "1952 Advance" (B/C or D/W version), wherein standard superhet selectivity can be switched in for that very purpose.

The point is that adjacent channel selectivity and true wide-band operation are factors which are diametrically opposed and, without going to a lot of complexity, you can't have all the cake and eat it as well.

However, while our present tuner gives wide frequency response, the very nature of the pass-band response curve—the near flat "top" and the fairly steep skirts—still permits of good selectivity and good sensitivity, too, quite adequate for most listeners. Besides the local stations, you should normally be able to tune in a good many country and interstate stations.

COMBINATION

From the aerial to the whistle filter output the circuit is essentially that of the current wide-band AM tuner, while from the second twin triode to the speaker it follows the design of the "Playmaster Baby" amplifier.

In the converter stage, any of the appropriate miniature valve types could be used, provided the necessary changes in the socket connec-

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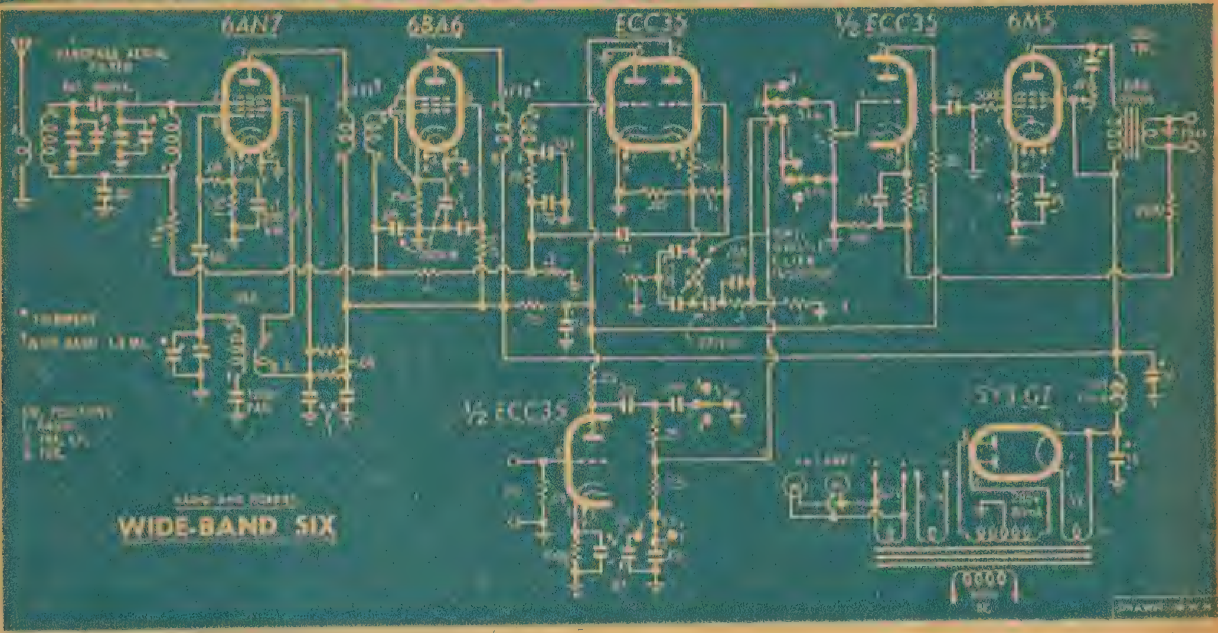
COMBINES NEW TUNER WITH "PLAYMASTER BABY"



The 4pf "top" coupling capacitor in the bandpass aerial filter can be made up simply as discussed in the text. The 6SL7GT valve can replace the ECC35's without circuit change. The values of the feedback resistor at the voice coil winding should be 1700 ohms for an 8 ohm winding and 1000 ohms for a 2 ohm winding.

tions and electrode operating voltages are made. You could even use the standard-sized octal-based converter if you enlarge the hole in the chassis.

In the case of the 6AN7, we use cathode biasing of just over two volts to go with a screen and oscillator plate voltage of about 85.

The band-pass filter in between the aerial and the grid of the converter follows usual engineering design practice for providing a fairly steep-sided and flat-topped response curve. The important point is that, following the description of our wide-band AM tuner, suitable coils for the broadcast band are now standard items.

BAND-PASS COUPLING

The "bottom" coupling medium is the .02 mfd capacitor. This capacitor also acts as the AVC line bypass, but as it is an important part of the band-pass filter design, its value should not be altered unless the coil manufacturer's data suggests so.

The "top" coupling capacitor is fairly critical if a reasonable flat top to the response curve is to be obtained. We found the value of 4 pf to be a better all-round choice than the 2 to 3 pf mentioned in the August issue. This capacitor value can be made up quite simply with twisted hook-up wire. More of this point later.

Note that the oscillator coil must be suitable for an intermediate frequency of 1900 kc and for which a padding capacitance of 120 pf is required. The IF transformers are designed for wide-band response. All these factors are taken care of when you purchase the coils and IF transformers as a wide-band coil kit. The kit also includes the padding capacitor.

As in the previous designs, we used a high Gm valve in the IF stage. In this case, it is the miniature 6BA6. Our experiments with a number of brands of wide-band kits indicate that running the 6BA6 under its maximum gain conditions may lead to intermittent instability, due to slight variations in valves and IF transformer construction. What may be OK for one type may be a little "touchy" with another.

Fortunately, the reserve gain normally available allows us to operate the 6BA6 at slightly reduced Gm with consequent stability under all conditions. The gain reduction is not normally noticeable because of AVC action. We achieved it by increasing the bias to 2 volts with a screen voltage of 100 at "no signal" condition. This is in line with local manufacturers' preference to minimise variations in valve input impedance.

TWIN-TRIODE

For the combined second detector and cathode follower stage we retained the twin-triode valve, but selected the more readily obtained octal-based type. If necessary, the 6SL7GT can take the place of the ECC35 without change in circuit values.

The grid and cathode of the first section is used as a diode detector, the anode being simply tied to the chassis. RF filtering precedes the diode load resistor as a precautionary measure.

A necessary condition for the satisfactory operation of the whistle filter circuit is that it be fed from a low impedance source. This is achieved with a cathode follower stag
using the second half of the first twi
triode. The plate is fed from the H
decoupled point for the audio triode

The 10 kc whistle filter inducto
is normally supplied as part of th
wide-band coil kit. It is provide
with an iron slug for adjustmen
of the inductance to the exact valu
required.

Between the whistle filter outpu
and the function switch feeding th
audio stages, we have inserted
simple network of two resistors an
a capacitor to provide a fixed amour
of treble lift to offset the sma
amount of attenuation introduced b
the tuning system and the RF filt
at the diode load.

SWITCHED COMPENSATION

From here on, the circuitry follow
that of the Playmaster Baby ampl
fier, with the small exception that f
the sake of some simplicity in switc
ing, we have used the same amount
treble de-emphasis for both the 78
and the LP (microgroove) discs. Th
enables us to use a single gang 4-po
3-position. The alternative wou
have been a 2-gang, 2-pole, 5-positi
switch, the nearest standard si
which would perform the requir
functions.

The compensation requiremen
for the 78A and LP are sufficient
close for them to share a compromi
amount in this particular case.

One section of the second twi
triode valve provides the switch
compensation for the disc recordi
standards. Either crystal or magnet
type pick-ups can be used. The .
megohm pick-up load resistor at t
grid of this triode section is a co
venient method of closing the g

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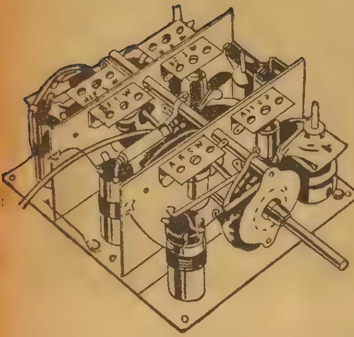

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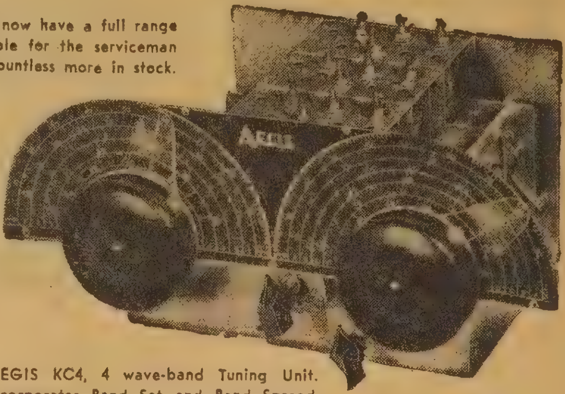

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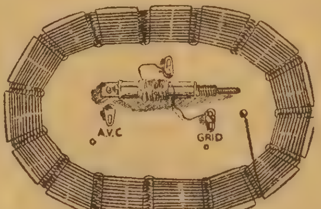

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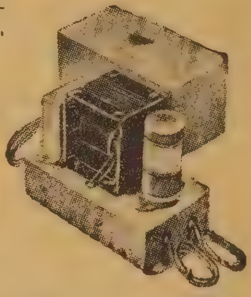

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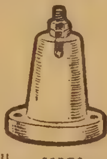
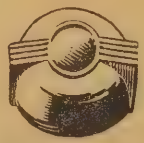
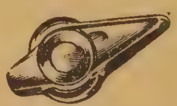


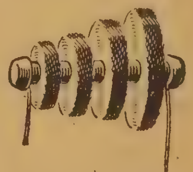
Full range of AEGIS Insulator Ceramics available.



AEGIS MV6 TUNING KNOB. 1in diam. Brass inset. Walnut or Ivory. Price 1/2 ea. Other types, all sizes available, 1/2.



AEGIS MV7 POINTER. Heavy duty, black, incl. grub screw. Price 2/2



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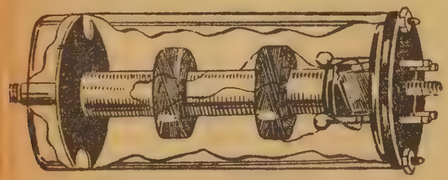

AEGIS TRANSFORMER, Type J9, 455 KC. Permeability tuned. Price 21/3.

Range of others available.

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and at:— 194 Marius Street, Tamworth. Tel. B466.— 73 Peisley Street, Orange. Tel. 413,
and 47-53 Molesworth St., Lismore

in the bass register between the initially different characteristics of the crystal and magnetic pick-ups.

It does not, of course, affect the resonance peaks in individual pick-ups. The normal treble de-emphasis will lessen the severity of such peaks, while further reduction can be obtained with the tone control, if desired.

The switch section S1c controls the bass boost for the pick-up while the section S1d controls the treble de-emphasis. Switch section S1b shorts the radio program output to prevent "play-through" when using the pick-up.

The volume control at the grid of the second triode section of this valve handles the output from either the radio program or pick-up. This stage provides adequate gain to drive the high-Gm 6M5 output pentode to its full output of the order of 4 watts.

HT DECOUPLING

The HT feed to both sections of this twin-triode is decoupled from the HT line by the .05 megohm resistor and the 16 mfd electrolytic capacitor.

The 6M5 stage is quite straightforward, the 5000 ohm grid stopper resistor being normal treatment for high GM power valves to prevent parasitic oscillations.

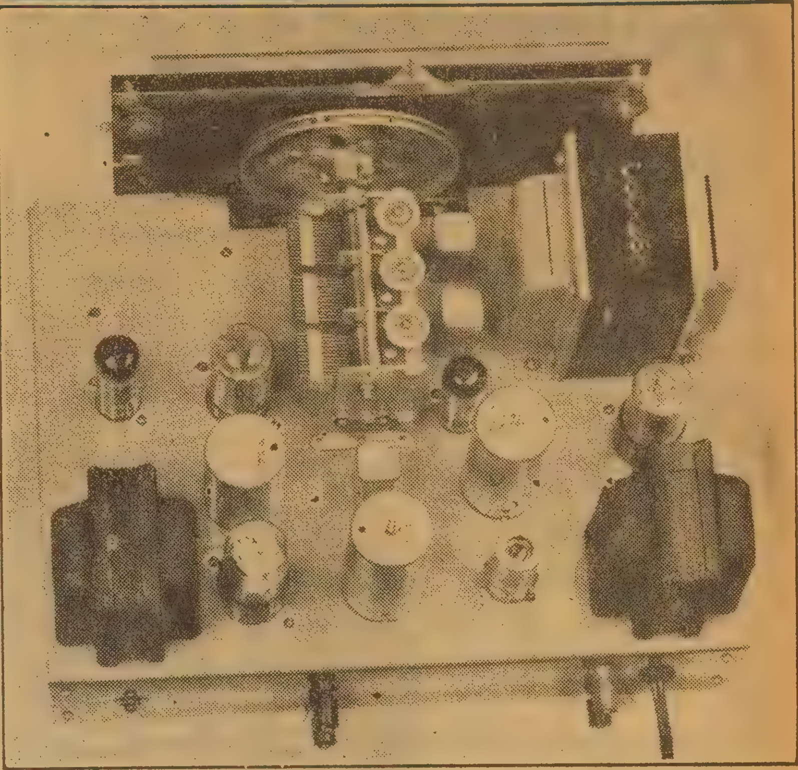
The simple "top cut" tone control between plate and screen may seem somewhat incongruous with a wide-range set, but it has its use. There is the point already mentioned of taking care of any annoying resonance peaks in some pick-ups, as well as noisy surfaces on worn discs. There is the other factor, emphasised rather forcibly by wide-range radio reproduction, of discrepancies in the quality of some audio programs transmitted from discs.

Then there is the case of intermittent electrical interference. All this can be accentuated by the extended high frequency response of a good quality speaker system.

This tone control provides a simple answer to these points. When not required, the tone control capacitor has no effect on the wide frequency response.

It is emphasised, however, that the benefit of this tone control is not to be confused with the facility of a top-cut filter used, for instance, in the speaker voice coil circuit. Each has its application, as explained in an article on the subject only last month.

A REAR VIEW OF THE CHASSIS



At the right of the gang leading toward the chassis rear are the first and second aerial coils, the 6AN7, IFT1 and 6BA6. In line from the rear of the gang are the oscillator coil and IFT2. In line to rear from the left-hand side of the gang are the the second ECC35, the 10 Kc whistle filter coil and the first ECC35. At the extreme left are the 6M5 and the output transformer while the power transformer, the 5Y3GT and the filter choke are at the extreme right. The aerial and earth terminals are at the right rear, the pick-up terminals to the left of the centre rear.

On the matter of the output transformer, you may intend using a standard speaker transformer for the time being, possibly expanding later to a good quality job. If you do adopt this approach, mount the speaker transformer on the chassis so that the plate lead length of the output valve is kept down to a matter of inches.

On the other hand, good quality speakers do not normally carry a speaker transformer. You are then faced with the decision as to the quality and type of output transformer which you should buy.

Of recent times, quite a few people have purchased the Rola 12 OX, for

PARTS LIST

- 1 Chassis 12½in x 9¼in x 2¾in.
- 1 power transformer 285V a side 80mA, 5V 2A, 6.3V 2A, 6.3V 2A.
- 1 30 Henry 75 mA filter choke
- 1 Output transformer 7000 ohms to 15 ohms (see text)
- 1 3-section miniature gang tuning capacitor
- 1 dial with glass to suit gang (USL 32)
- 3 gang-section trimmers.
- 1 set bandpass aerial filter coils, broadcast band, (2 coils)
- 1 broadcast oscillator coil to suit 6AN7 (or similar) for 1.9 Mc IF.
- 2 wide-band 1.9 Mc IFT's Nos. 1 and 2
- 1 10 Kc whistle filter coil (approx. 100 mH)
- 2 9-pin miniature valve sockets, 3 octal sockets, 1 7-pin miniature wafer socket, 1 miniature valve shield and mounting base for 7-pin socket (Clix type or similar)
- 1 4-pin miniature plug and socket.
- 1 4-pole, 3-position switch.

VALVES

1 6AN7, 1 6BA6, 2 ECC35 (or 6SL7GT), 1 6M5, 1 5Y3GT

CAPACITORS

3 25 mfd 40PV electrolytics, 3 16 mfd 525PV electros, 3 .1 mfd 400VW, 4 .1mfd 200VW, 2 .05 mfd 400VW, 1 .05 mfd 200VW, 1 .04 mfd (2 .02 mfd in parallel), 2 .02 mfd, 1 .01 mfd, 2 .005 mfd mica, 1 .001 tub, 1 250 pf, 1 120 pf (low tolerance), 2 100 pf, 1 50 pf.

RESISTORS

- 1 2 meg. ½w, 1 1 meg. ½w, 1 1 meg. potentiometer, 2 .5 meg. ½w, 2 .25 meg. 1w, 1 .25 meg ½w,
- 1 2 meg. ½w, 2 .1 meg. ½w, 1 .1 meg. potentiometer 1 .075 meg. 1w, 2 .06 meg. 1w (or 1 .03 meg. 2w)
- 2 .05 meg. 1w, 3 .05 meg. ½w, 1 .05 meg. potentiometer, 1 .025 meg. ½w, 3 5000 ohm ½w, 1 2500 ohm ½w, 1 1500 ohm ½w, 1 250 ohm ½w, 1 175 ohm, 1w, 1 175 ohm ½w.

SUNDRIES

- 4 knobs, 4 terminals (2 red, 2 black) 2 6V dial lamps, 3 3-tag 2 4-tag and 1 8-tag mounting strips,
- 1 1in. threaded mounting pillar, 2ft shieded hook-up wire, power flex and plug, tinned copper wire, hook-up wire, nuts, bolts, grommets, lugs solder, etc.

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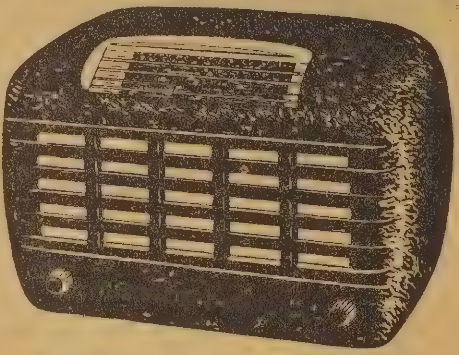

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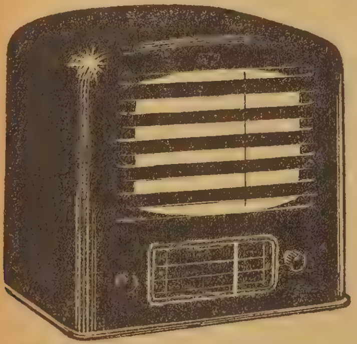
(1) High gloss walnut bakelit cabinet.
(2) Attractive all-States edge-li dial complete.
(3) Cadmium plated chassis cu for 4 valve superhet.
(4) Aerial coil in can.
(5) Oscillator coil to suit dial.
(6) I-F Transformer No. 1 455 KC
(7) I-F Transformer No. 2 455 K
(8) Dial Drum for above.
(9) Spindle for Dial Drive.
(10) Speaker baffle.
(11) Walnut knobs.
(12) Strong carton.



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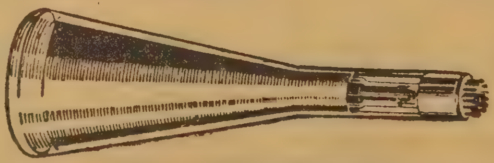


5BP1 CATHODE RAY TUB

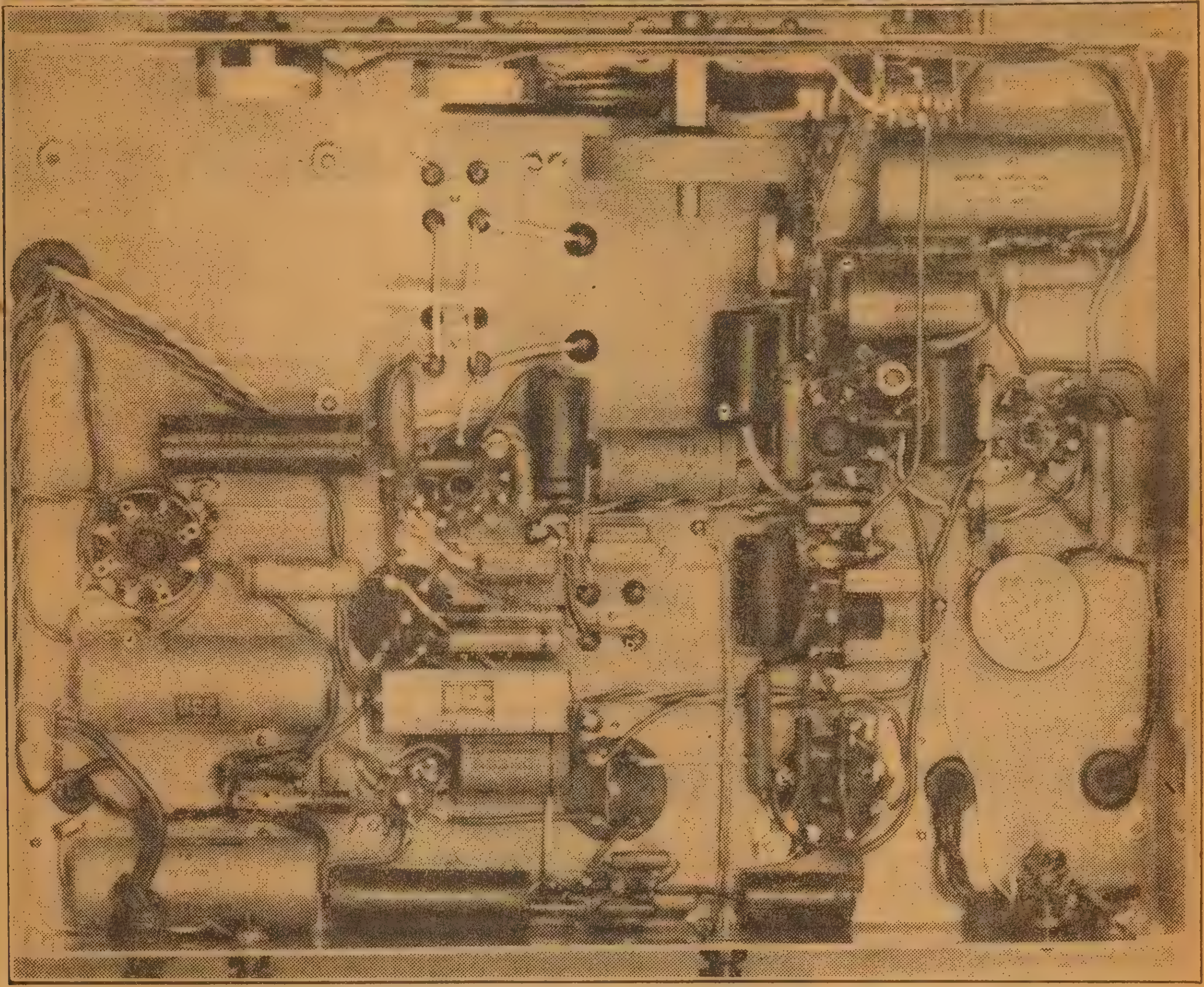
Green Screen —

Originally Cost £16

Now 9/11

ALSO AT 26 HUNTER ST., NEWCASTLE.

UNDERNEATH PHOTO SHOWS PLACEMENT OF PARTS



Used in conjunction with the information given in the text, this view should enable you to lay all the components in place with a minimum of effort. Note that the chassis has been kept clear of components around the wiring between the two aerial coils and the gang section.

example, and used an appropriate output transformer to feed into its 2 ohm voice coil. They have suddenly been made aware of the listening problems introduced by extended range reproduction, that of apparent accentuation of all the faults and bad portions of 78 rpm discs which previously sounded quite well on the older or lower quality speakers.

TOP-CUT FILTER

An effective answer to this problem is a variable top-cut filter having sharp cut-off points which can clip off the temporarily undesirable upper frequencies, without marring the response below the cut-off point. Cut-off frequencies of 6.5 and 8.5 Kc are a good compromise for most requirements.

We have described such devices for use in speaker voice coil circuits, but they are practicable only for 15 ohm voice coil impedances. The logical attack is to use a 15 ohm output transformer, insert the top-cut filter and feed into a 15 ohm speaker or into a small auto-transformer which steps the impedance down for a 2 ohm speaker, or for an 8 ohm speaker, for that matter.

Fortunately the problem can be solved from the outset in the light of a particular wide-range output transformer which has become available. This transformer provides a 15 ohm secondary, or voice coil winding, with tappings at 8 ohms and 2 ohms.

It can therefore be used to feed at the appropriate impedance to most of the better quality speakers at present available. The additional advantage, of course, is that if you happen to have a Rola 12-OX or an 8 ohm extended range speaker, and you find that a top-cut filter is highly desirable, the tappings can be quickly arranged to feed out at 15 ohms to such a filter and stepped down again via an auto-transformer to suit the speaker.

COLOR CODE

VALUE	BODY	END	DOT
2 meg.	red	black	green
1 meg.	brown	black	green
.5 meg.	green	black	yellow
.25 meg.	red	green	yellow
.2 meg.	red	black	yellow
.1 meg.	brown	black	yellow
.075 meg.	violet	green	orange
.06 meg.	blue	black	orange
.05 meg.	green	black	orange
.025 meg.	red	green	orange
5000 ohms	green	black	red
2500 ohms	red	green	red
1500 ohms	brown	green	red
250 ohms	red	green	brown
175 ohms	brown	violet	black

As a matter of interest to readers who already have 2 or 8 ohm speakers and are blighted with some of the problems of extended range listening, we would suggest that you read the article on page 91 of the September, 1952, issue of Radio and Hobbies.

POWER SUPPLY

Getting back to the design of this set, the power supply employs a 285 volts per side transformer rated at 80 mA and feeding into a 5Y3GT rectifier. Filtering is provided by a 30-henry choke and a pair of 16 mfd electrolytic capacitors. This order of filtering is desirable in view of the use of bass boosting for pickup and the improved bass response obtainable from a good quality speaker used on a suitable baffle or in a vented enclosure.

The filter choke is rated at 75 mA,

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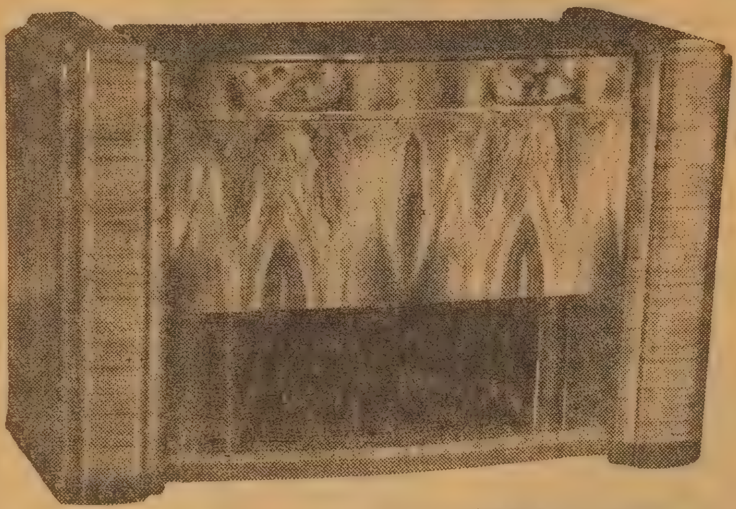

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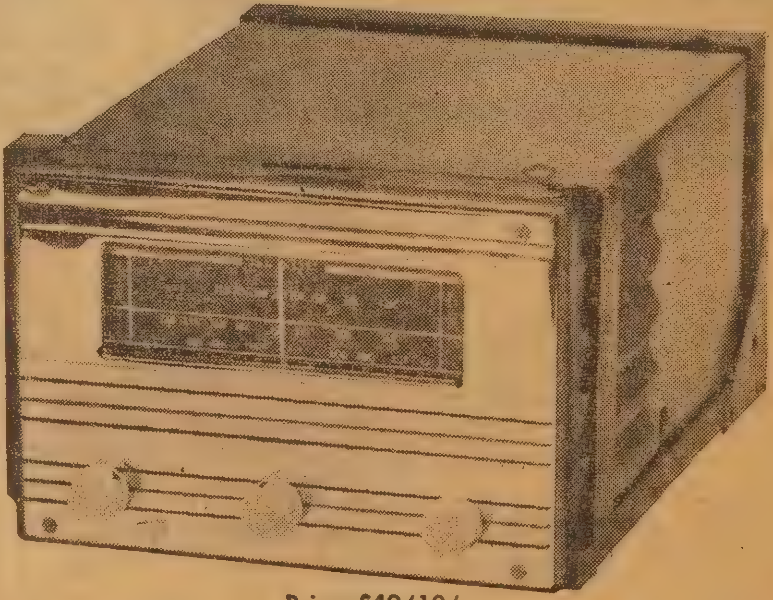

Price £49/10/-

Can be seen at Radio Despatch, Wembley House, 841 George St., Sydney, Lavis Radio, Elizabeth St., Sydney and Wollongong.

South Australian distributor: L. Cockburn, 164 Gover St., North Adelaide, S.A.

SLADE'S RADIO PTY. LTD.

LANG ST., CROYDON, NSW.

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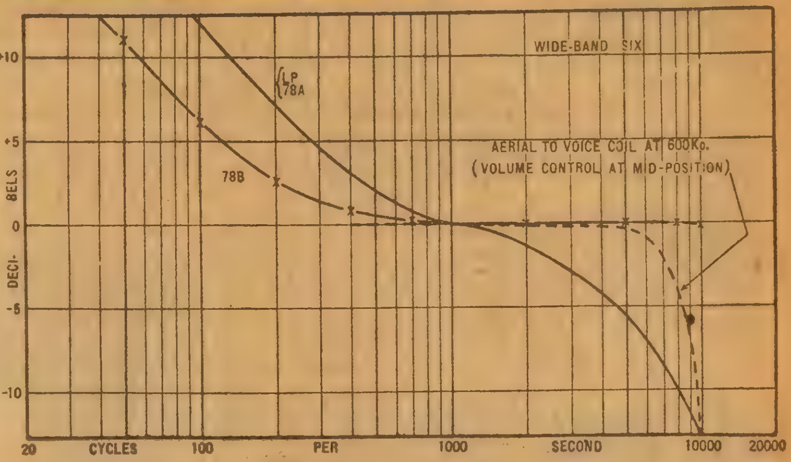
as this is the next standard rating above 60 mA. The available HT voltage from the filter will be of the order of 270 volts.

So much for the circuit design.

We tried to employ an existing chassis design to take the required layout, but with no success. The new design has overall dimensions very close to those of the 1952 Advance. We could have saved a little here and there, but there was no point in unduly restricting the size.

The block lines for the rear view of the chassis indicates the placement for the components on the chassis top. From the underneath view, the orientation of the valve sockets, coils and IF transformers plays an important part in the placement of the minor components and in the length of the "hot" plate and grid leads.

RESPONSE FOR RADIO, PICKUP



Frequency response curves for the three positions of the function switch. The two positions for "pick-up" take care of the different recording standards. The response in the "radio" position differs slightly from that obtained previously due mainly to the mid-position setting of the volume control.

To assist you in this respect, this is the way we did it. Viewing the chassis underneath from over the rear edge, the gap between pins 1 and 9 of the 6AN7 socket is toward the tone control, the gap on the 6BA6 socket toward the aerial and earth terminals, the keyway on both ECC35 sockets toward the output socket, the gap on the 6M5 socket toward the dial flywheel. The position of the rectifier is not important but we have it with the keyway toward the chassis rear face.

The coils are arranged so that the grid pin is closest to the gang. In the case of the IF transformers, you will readily see in which of the two possible arrangements the plate and grid leads will be shorter. See that the IF transformers go in their correct positions, that is, No. 1 following the converter.

We used solder lugs under the nut in the following positions for connection to the chassis — the gang mounting bolts near the first aerial coil and the 6AN7 socket, the 6AN7 socket near the IFTI, both bolts of the 6BA6 socket, the nut on IFT2 away from the chassis rear, the 6M5 socket nut near the whistle filter, potentiometer.

See that all earth points make good contact with the chassis and connect them together with a run of light gauge tinned copper wire.

MOUNTING STRIPS

To provide additional mounting for components, two 3-tag mounting strips are held under two nuts of the filter choke, another 3-tag strip under the 10 Kc filter coil can nut near the second ECC35, a 4-tag strip under the IFT2 nut near the chassis rear face. An 8-tag and a 3 or 4-tag strip are mounted in the holes punched near the 4 by 3 function switch. A 1in threaded mounting pillar is secured to the mounting bolt of the second ECC35 socket near the switch.

With all this information plus the assistance of the underchassis photograph, you should be able to duplicate the layout of the original set in the knowledge that you should not run into any unaccountable difficulty.

In the parts list we have indicated the ½-watt size of resistor where it is electrically applicable. If you follow this idea, you will find the wiring just so much easier.

Remember that it is important that the centre spigot of the miniature valve sockets should be earthed as it acts as a shield between the valve pin connections. We suggest that you use a wafer-type of 7-pin miniature socket for the 6BA6 rather than the moulded type because of the considerably lower capacitance between the pins of the socket itself. There is at least one type of separate shield and shield mounting base available for these wafer sockets. It goes under the name of "Clix" shield.

For the octal-base valves, we used the moulded octal sockets having the metal surround for mounting purposes. This metal surround is very handy for making earth connections to the chassis.

We have arranged that the current drain on the 6.3 volt source from the power transformer roughly balanced between the two 6.3 volt windings. This works out conveniently in the actual wiring.

Keep components clear of the two aerial coil connections and their

(Continued on Page 98)

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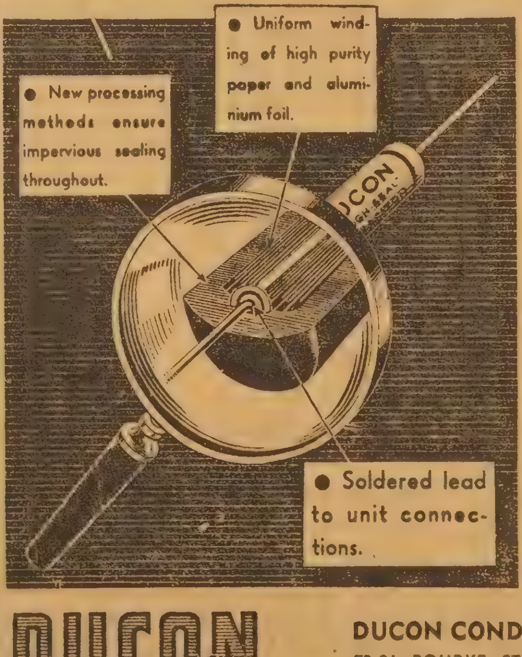
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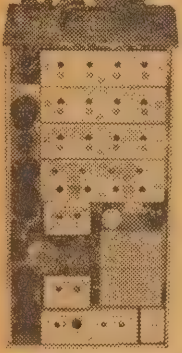

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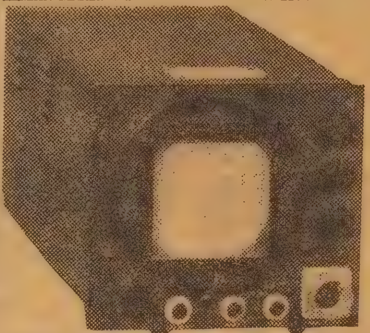

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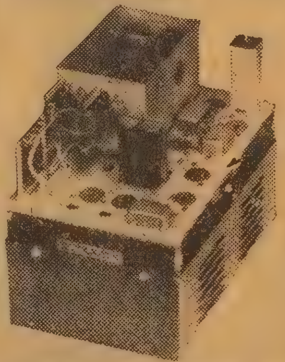

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A COURSE IN TELEVISION

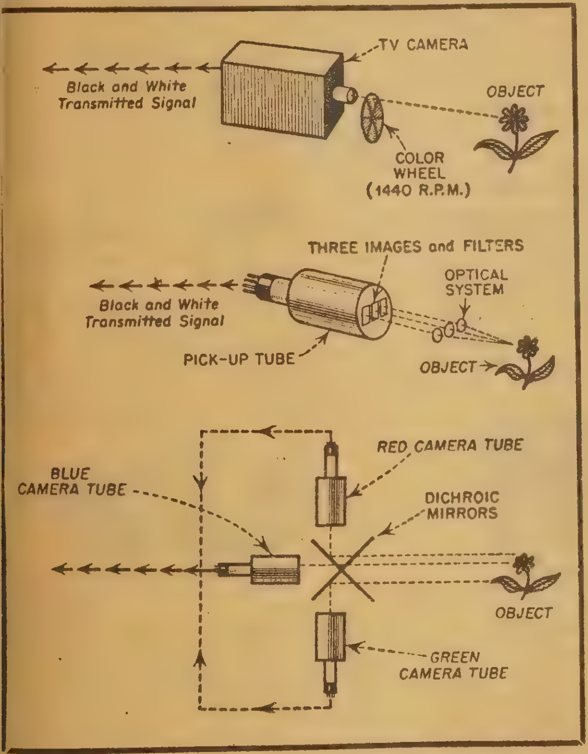
PART 41—TRI-COLOR PICTURE TUBES

The future of all electronic color television would appear to depend very largely on the production in quantity of reliable and reasonably-priced tri-color picture tubes. This article explains in greater detail than previously the principles of two or three of the most promising designs.

TRI-COLOR picture tubes are only a comparatively recent development. All early systems of color television relied on the use of colored ptical filters, the television circuit nd components handling only "black nd white" images.

This method is still used at the amera end, by both the mechanical olor-wheel and the electronic systems.

In the first case, a rotating color wheel or drum in front of the camera lens interposes three basic filters in sequence between the scene and the pickup tube. This latter, controlled by carefully synchronised line and frame pulses, delivers to the video amplifier a chain of signals corresponding in turn to the light and shade in the red, green and blue versions of the scene.



Illustrating at the left the three basic methods of color pickup at the transmitter end. All conventional systems use light filters in conjunction with tubes which translate mere light and shade into electrical impulses. At the moment, large-scale research is concentrated at the receiving end into tubes which reproduce pictures directly in color, without optical aids.

For the electronic sequential line principle, a special 3-way optical system projects red, green and blue versions of the scene side by side on the mosaic of the camera tube. The three images are scanned in sequence, line by line, as the spot travels from one edge of the mosaic to the other.

The resulting video signal is divided up electrically so that it can be translated by the receiver into three sets of color signals.

The RCA sequential dot system uses a set of dichroic mirrors, similar to those used in color cameras to produce separation negatives. These mirrors divert red, green and blue versions of the scene to three separate camera tubes, which generate entirely separate video signals.

The signals are "sampled" by the process explained last month to produce a composite video signal containing "information" about all three color images. All this, of course, makes for considerable complication at the transmitting end.

However, while it is obviously economical and convenient to keep television cameras as small and simple as possible, they are really much less important to the economy of the overall television system than are the tens of thousands of domestic color television receivers which can be expected to go into service.

Therefore, while some method of electronic color separation may still be possible in camera tubes, research in this direction has been on a much less urgent basis than it has been into the design of tri-color picture tubes.

MECHANICAL PROBLEMS

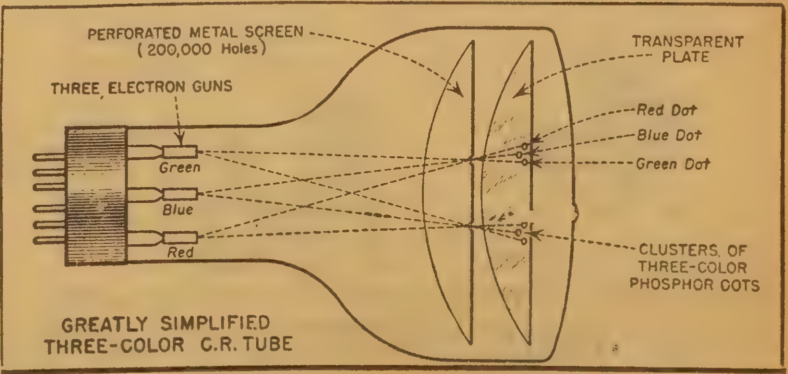
At the receiver end, the mechanical sequential frame system has thus far employed a rotating wheel or drum which interposes colored filters, in step with those at the camera, between the picture tube face and the viewer. The original image is always in black and white but the operation of the synchronised color wheel, combined with normal persistance of vision produces the illusion of a steady and completely colored picture.

The obvious limitation to this system is that the color wheel must always be larger than the face of the tube, so that the idea of a large, colored picture obtained by these means is impractical for reasons of bulk, unless a projection system is used.

The original so-called "electronic" systems used three separate black and white tubes with an appropriately colored filter in front of each. Then, by an arrangement of mirrors, or by projection, the three images were merged for the benefit of the eye into a single composite picture.

The need for three separate picture tubes and for a complete optical system to merge the images presented obvious problems of cost and space.

(Below) A simplified version of the BCA three-gun picture tube. The single gun tube uses the same screen and mask arrangement but uses a spiral magnetic field to make the beam approach the screen from differing directions.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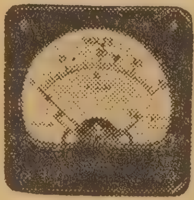

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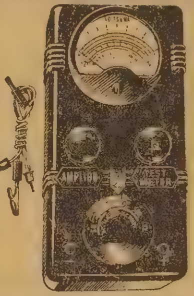

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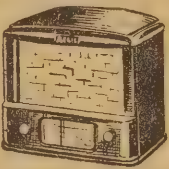

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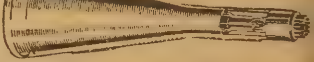

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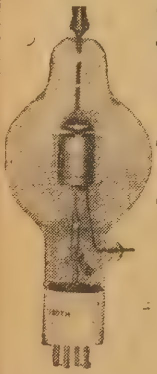

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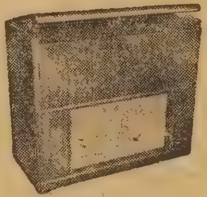

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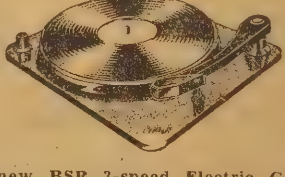

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ı additional difficulty arose from ꞓ fact that the three images had be kept in perfect register, re-iring careful matching between ꞓ deflection arrangements of all ree tubes.

It was later found possible, how-er, to produce phosphors which owed directly in the three primary lors and this simplified the all-ectronic presentation to the extent at it eliminated the need for the tical filters.

Problems of cost, bulk and the atching of tubes remained un-anged, however, and the very great ed was obvious for a picture tube iich would produce a colored image rectly on its own face and which uld be viewed directly, in keeping th the popular tendency in black d white receivers.

IRECT VIEWING

Having perfected the principle, the oduction of larger screen and pro-ction types could be expected to llow as a matter of course.

It was realised, also, that such a be would be applicable to all sys-ms of color transmission—sequen-l frame, line and dot.

As part and parcel of its campaign r all-electronic color, the RCA Com-ny in America has been respons-le to date for the bulk of re-arch into tri-color picture tubes. cording to statements, a large mber of ideas were investigated d pursued to the prototype stage, t the two which were selected r special development are those hich were announced about the iddle of 1950.

Subsequently, manufacturing data the tubes was made available other tube manufacturers.

At first glance, the production of e tubes would appear to involve ntastically fine working tolerances, t the designers regard the speci-ations as completely practical and laptable for mass production ethods.

The first of the RCA tri-color tubes sembles externally an "ordinary etal-envelope kinescope, with a hitish phosphor screen.

Inside the neck of the tube, how-ver, are three separate "gun" struc-ıres mounted side by side and emit-ng separate beams toward the ıorescent screen.

OMMON CONTROL

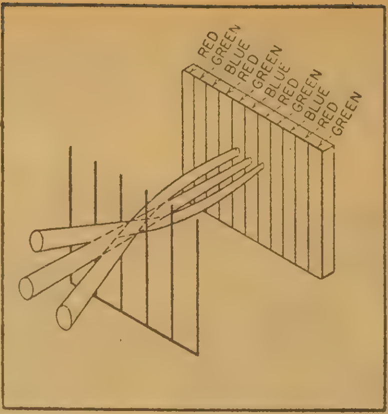
All three beams are accelerated, cused and deflected by a single stem of anodes and yokes, and, by aintaining the symmetry in the ıbe, all three react to them in the me manner. This largely elimin-es the registration problems which cur with three entirely separate cture tubes.

At the same time, since, the beams iginate from separate gun struc-ıres, their intensities can be sepa-tely controlled.

The real secret of the color pat-rn lies in the screen of the tube d a special mask which is mount-l immediately behind it.

Instead of the screen being cover-l with an even layer of phosphor hich glows white when bombard-l, there is deposited on it a tiny ıttern of dots involving three dif-rent phosphors, one glowing red ıe glowing green and the other ue.

The dots are in a definite series triangles and are so small yet ghtly packed that there are 117,000 ots for each color over the surface of the screen, or 351,000 dots in all.



The three-gun type Lawrence tube is rather similar in principle to the three-gun RCA tube, except that it uses a wire grid rather than a continuous mask. The grid acts also as an accelerator.

Behind the screen is the aforementioned mask, which is a metal plate perforated with 117,000 tiny holes —the same number of holes as there are color groups. Each hole in turn may be regarded as lying in front of each color group, partly obscuring it from the triple scanning beams.

Now since the beams originate at different points and are made to converge in the region of the mask, they must penetrate the holes in the mask from slightly different directions.

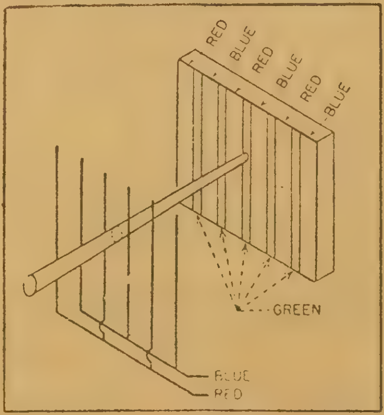
ANGLE CONTROL

Thus one beam, striking upwards, may consistently excite the blue phosphor dots. Another beam, veering downwards, may excite the red while the third, approaching from yet another angle, may excite the blue.

Obviously, having achieved this state of affairs, it is possible to make the whole screen glow blue, for example, by biasing to cut off the guns which excite the other two phosphors.

Similarly for red and green, or for combinations of any two or three of the colors.

The dot pattern is so fine that it cannot be discerned by the viewer nor does it interfere with the normal line structure of the picture. Thus, any combination of hues can be obtained simply by controlling the intensity of the three separate beams.



Illustrating the principle of the single-gun Lawrence tube. Voltages on the two deflector grids either allow the beam to pass straight through to the green phosphor, or deflect it sideways to the red or blue.

Its application to a color receiver becomes obvious. The video signals corresponding to each of the three colors are made available and fed to the respective "guns" at the appropriately synchronised intervals. Separate red, green and blue phosphors are excited in the screen, in step with the color sampling of the original scene.

MIXED HIGHS

It is only a matter of arrrangement whether the sampling follows a sequential frame, line or dot pattern.

In the RCA system, as explained last month, the higher frequency signal components are fed to all three picture tubes simultaneously, so that a sudden transition from a light to a dark area (or vice-versa) momentarily blacks out all three tubes or (vice-versa) causes them to glow brightly.

This simultaneous action, involving all three colors, produces a virtual black and white outline image which overprints the color produced separately by the tubes and imparts detail to it. This "mixed-high" system is a method of transmission, however, and is not fundamentally related to the design of picture tubes.

The single-gun tri-color picture tube is similar to the three-gun tube, in that it uses the same arrangement of masking plate and screen dot pattern. The difference lies in the method which is adopted to make the electrons strike the combination at a slightly oblique angle.

Only a single electron gun is employed, designed along conventional lines. The focusing and deflection arrangements are also conventional with the exception that an additional yoke is provided designed to operate at the color sampling frequency.

SPIRAL CONTROL

This is so arranged that it imparts a slight spiral motion to the electron beam so that it appears to approach the screen and mask, not from the exact line of the gun, but from points on a circle outside the gun.

The spiralling signal is synchonised in such a way that the beam approaches the screen at the appropriate times and from the appropriate directions to excite respectively the red, green and blue phosphors.

The beam is intensity modulated by the video signal so that, for say red areas, the beam is at full intensity only when it spirals through to the red phosphor dots. Simultaneously for other colors or color combinations.

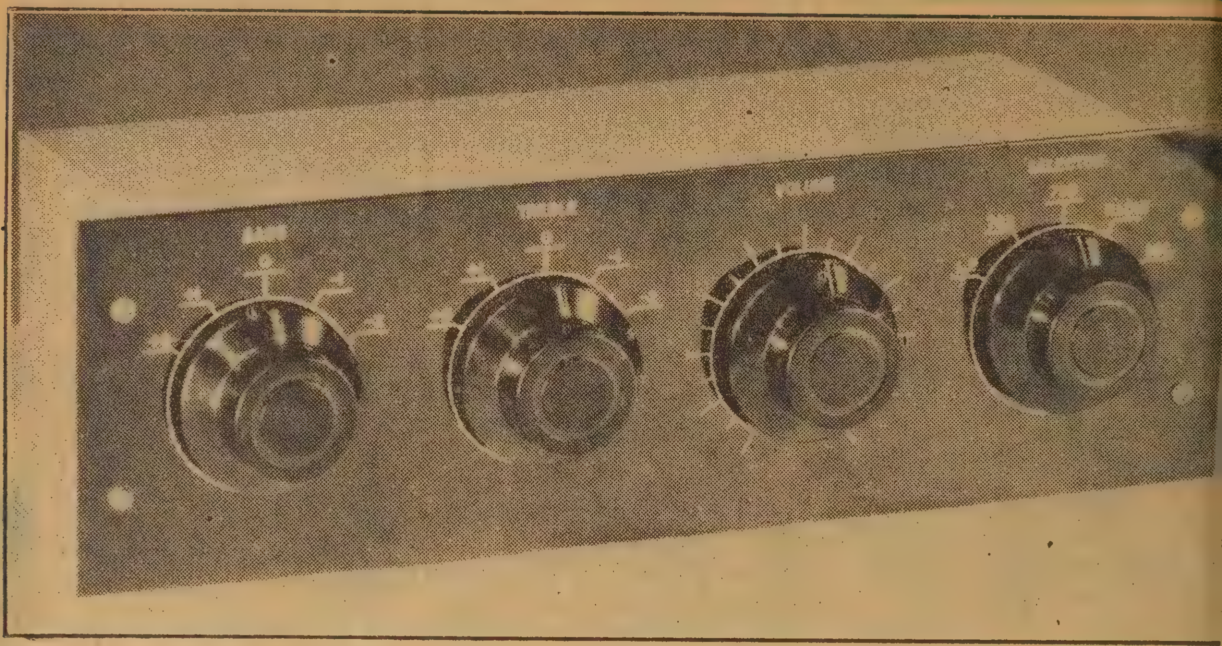
For highlight areas or light edges, all three color dots would be excited, while areas or shadow or dark borders would be achieved by limiting the excitation.

So much for the two tubes which were largely pioneered by RCA in America.

Much publicity was given, a little later, to two other tri-color tubes designed by Dr. E. O. Lawrence and small numbers of these have been manufactured in 22in metal shells for the CTL Laboratories in Stamford, Conn., USA.

Essentially, the Lawrence tubes

(Continued on Page 104)



The control panel is laid out as for the Control Unit No. 2. A commercially engraved escutcheon as shown is available, giving the unit a most attractive appearance.

PLAYMASTER CONTROL UNIT No. 3

This is really an expanded version of Playmaster Control Unit No. 2 giving somewhat greater flexibility. It is particularly intended for use with microphone input when the gain control must be well advanced. It is completely stable, with a low hum level, and it features a low impedance output circuit taken from a cathode follower stage. It is suitable for use with any amplifier having a sensitivity of about .5 volts.

by John Moyle

THIS No. 3 Control unit was developed during some disc recording work using the Playmaster No. 2 amplifier. For this recording, I wanted to use a crystal microphone some distance from the source of sound, which meant running the gain control virtually wide open. This constituted quite a severe test in the matter of hum, as I was really trying to duplicate a performance more akin to a regular recording studio set-up rather than a more modest outfit for the home.

Now the No. 2 Control unit, in order to avoid using more than one twin-triode, used the same triode section for both microphone amplifier and pick-up compensator stage, and it was therefore necessary to wire the microphone input, with its 5 meg load, to an ordinary wafer switch.

LOW LEVEL WORK

This is quite all right as long as one doesn't need to work more than a few feet from the microphone, and I have made excellent records of small groups, and of instruments, such as the piano, without noticeable hum.

But there is only one way to avoid any appreciable hum at all being picked up by the high impedance input channel, and that is to completely shield the mike lead right up to the grid of the first amplifier valve. And that rules out entirely any idea of switching the input. It means a separate triode section for the job, with any switching carried out in the plate circuit where the level is much higher, and the hum pick-up position isn't difficult.

Thus the first major change in the circuit is the use of another valve. If this is a second twin triode, we now have a fourth triode section for use if we so desire.

CATHODE FOLLOWER

After carefully scanning through the circuit, and assessing possible use for this extra triode, it was decided to use it as a cathode follower output section for coupling to the main amplifier.

The No. 2 unit coupled into the amplifier at a fairly high impedance, with something like .2 megs at th pre-amplifier and 1meg at the am plifier itself. To avoid high-no loss, a section of coaxial cable wa used for this lead, which was qui all right, except that it was still advisable to avoid too long a conne tion.

The cathode follower provides a interconnection at quite a low impec ance, and ordinary shielded cable ca be used without trouble.

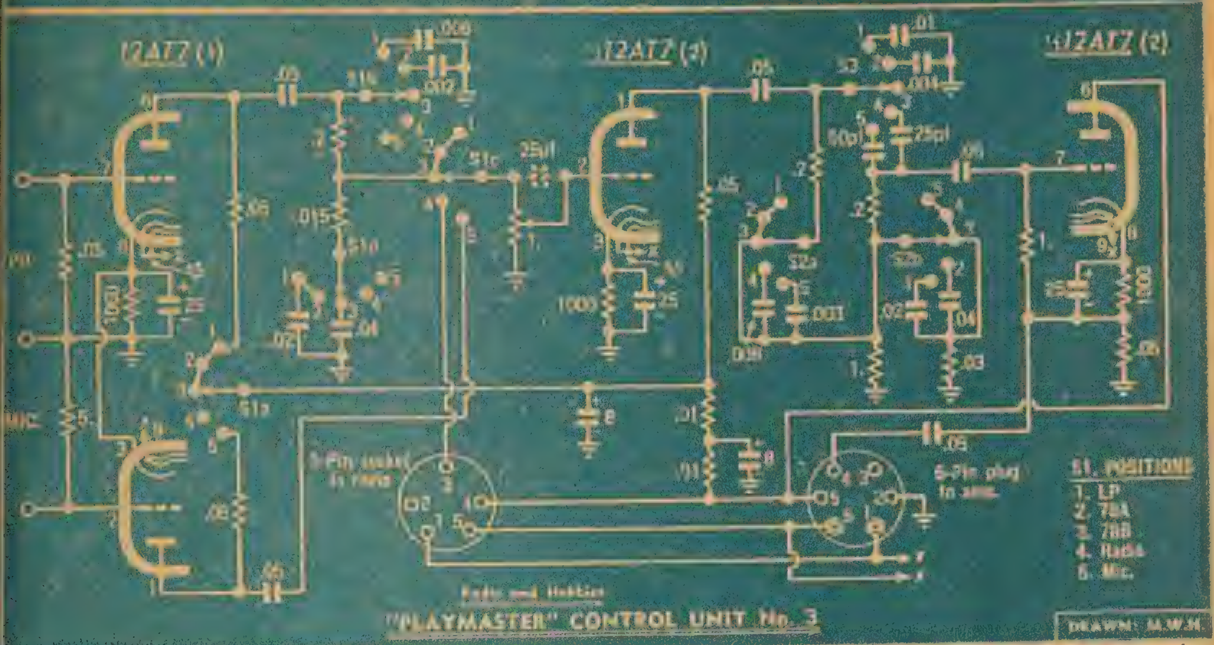
TWO VALVES USED

Several other points have bee picked up in the process of elabora tion, none of which involve ar great complexity or expense, but a of which tend to make small in provements in one way and anothe

The net result is that the No. unit is an excellent job for use wi any amplifier having a sensitivity about .5 volts, and preferably n better than about .25 volts. All th Playmasters are included in th class, and nearly every other ty of standard amplifier as well.

As a review of performance, ar taking .5 volts across the cathode fo lower output as a reference, th sensitivity on the microphone cha nel is 7mv, on the pick-up channel mv, and on the radio input .2 vol As few amplifiers will be run full output, it is more than like

CIRCUIT DIAGRAM OF THE CONTROL UNIT No. 3



The circuit uses two valves. At first sight the connections appear a little bewildering, but are quite easy if you study the switch positions carefully before wiring up. Shielded leads are brought out for Microphone and Pickup. The braid is earthed at the mounting bracket. The 25 pf condenser across the volume control is optional.

at in practice these figures can be ttered by at least two or three to ie.

In place of the single ECC33, we ow use two 12AT7's, which are phycally much smaller, and which fit the same size bracket quite easily. e found it convenient to mount em side by side, with one socket one side, and the second socket the other. This allows shortest nnections to be made between the rst triode, which has a number of nnections associated with the selecr switch, and the second triode, hich is concerned with the extra mpensation and output circuits. hus the unit is divided down the ntre both mechanically and elecically to avoid coupling from input output circuits.

The 12AT7 has a little higher gain an the ECC33, and although not riginally intended for audio work, well adapted to our use.

ELECTOR POSITIONS

Considering the unit from input output, we have the first 12AT7 perating one-half as a microphone mplifier, and the other as the pickp amplifier. In the latter case, the alve works into a compensation ciruit, as with Unit No. 2, to give the equired response curve for 78 reords, both British and American, nd all LP records. This is accomlished by three sections of the elector switch, working into a standrd type of voltage divider and conenser network. The curves for hese three positions are shown erewith.

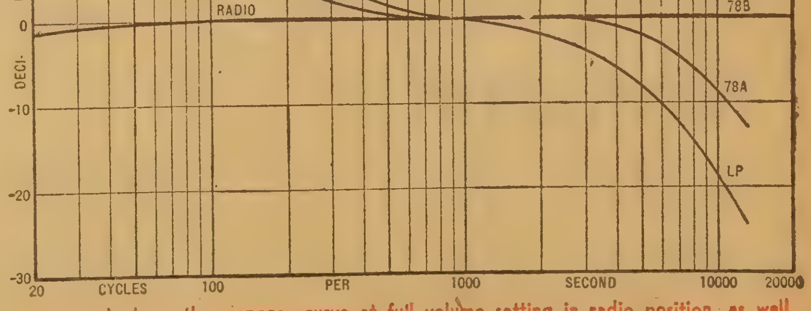
The selector provides a radio posion in which the input from the ner is fed directly to the volume ontrol, and a microphone position which the output from the microhone amplifier is brought in.

The fourth section of the doubleank switch is used to remove plate voltage from both microphone and pickup amplifiers when these are not in use. This avoids possible coupling and "play-through," which might otherwise appear, either through switch capacity, or through coupling in the common cathode bias resistor which we have used in the interests of simplicity. It also helps the decoupling circuit, which at no time handles the plate current of more than two valves in cascade.

When using the microphone circuit wide open, and with the tuner connected, there may be some radio play-through if the tuner is tuned to a station, due to capacity between switch contacts. This can easily be avoided either by pulling out the tuner plug, or by fitting a switch to it short-circuiting its output lead to chassis when the microphone is used.

We might have avoided this by placing the mike on the far side of the pickup switch positions, but we didn't do this to keep the switch positions on both units the same. It's only a small point, which you can easily cover as suggested.

You could arrange to earth the radio input by moving the switch arm of S1b to earth, and wiring the top cut condensers from their switch points back to the .05 coupling con-



This graph shows the response curve at full volume setting in radio position, as well as the curves for the various pickup positions. The slight drop at low frequencies is deliberate to give attenuation at the extreme bottom end below 50 cycles. There may be a slight drop at 10 Kc with the volume control in mid-position.

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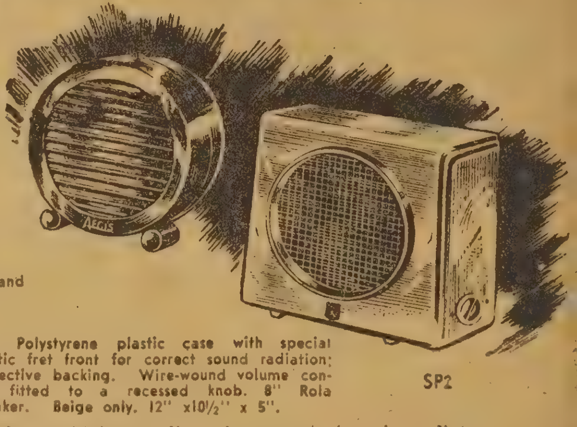

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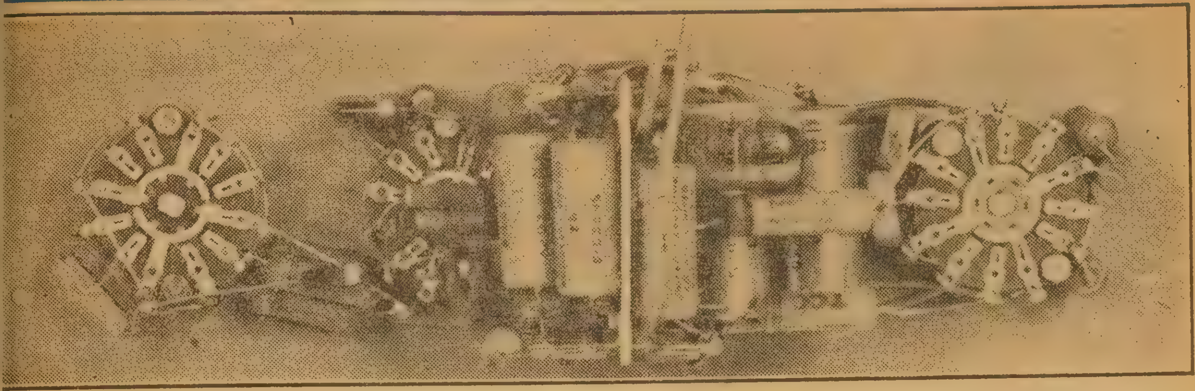
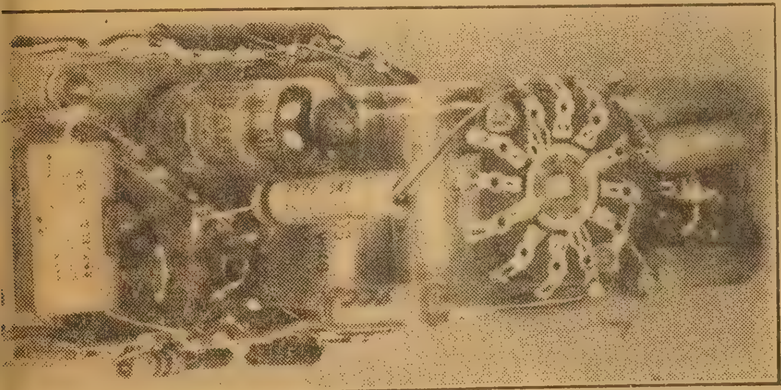


Note that miniature electrolytics and other parts make construction compact. The selector switch is at the right. The bottom section s S1b with S1a beneath it. The top section is S1d with S1c beneath it. The left hand switch is S2, and the central switch S3. The volume control is obscured beneath the two 8 mfd. condensers.

ser. Position 5 would then be nected to the radio switch point S1c, thus killing it while using the ‹e. This scheme is a little awk- rd physically, because it removes umber of connections from vari- s switch points to which they now conveniently tied. We didn't



A close up of S1, the socket of 12AT7(1), 12AT7(2), decoupling condensers &c. Note the use of terminal strips to mount components. The two shielded leads to microphone and pickup run out of the picture at left.

other, preferring to use a tuner vitch.

The output from the first two iodes runs via the volume control the second two, the first of which an extra tone compensation sec- on on much the same lines as the rst. Its values are a little different, owever, in order to get the degree boost and cut we desired.

In order to improve the decoupling the plate circuits of these first iree triode sections, we used a ouble-section filter with two minia- ire 8 mfds electros and two .01 re- stors. This seems to be more effec- ve than a single section, and we nd it impossible to cause any motor- oating with any Playmaster, no iatter what setting of controls is sed. It's a minor improvement over o. 2, which could be made to motor- oat under extreme provocation.

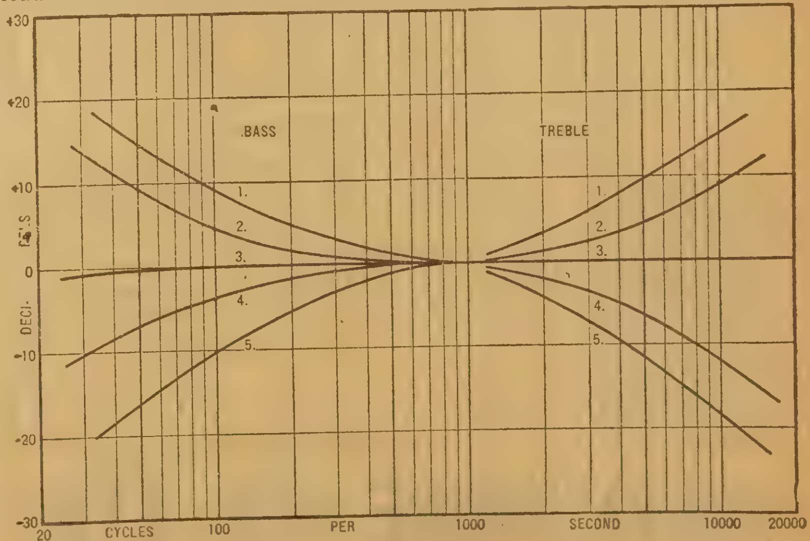
The double decoupling allows a ropping resistor of only 2000 ohms be used in the Playmaster ampli- er proper. As a result, about 230 olts is available for the valves in e control unit, to get the greatest ossible voltage output from them, ainly as increased reserve. Nor- ally, both valves use only a small ortion of their maximum available output voltage as a precaution against distortion.

The cathode follower stage is quite standard. It gives no gain—in fact, a very slight drop in gain, but it is often used as a coupling method in cases such as this. It could be simplified by using a single resistor of 5000 ohms as a combined bias and load resistor, but the extra components allow a much greater reserve of output volts and, once again, lowered distortion.

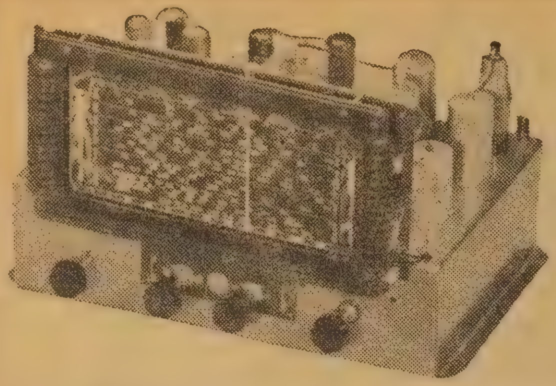
In building the unit it is important to see that the filament leads are not connected to the chassis. These are suitably dealt with in the amplifier proper. As it is, hum level is so low as to be virtually the minimum obtainable without extreme precautions such as using DC on the filaments and grouping all earth returns to each stage to common points within the unit. This latter would make construction so involved that normally it isn't attempted except for specialised equipment.

This tiny residual hum—the kind of thing I listen for when everyone is in bed and the birds aren't chirping!—is a chancey thing. Apparently due to some cancellation effects, one unit I have is absolutely silent—not a sound from it using a speaker notorious for its 50-cycle sensitivity. A second one, built apparently in the same fashion, has a tiny little bit, which I just can't remove. I'll admit, it's a bit superfluous to try, because it isn't audible over the faintest music, but you know how it is when one gets involved in this amplifier business!

Constructionally, the unit isn't hard because you can mount four terminal strips to the mounting



This graph shows the degree of extra bass and treble controls in each of the ten positions. Neither control is effective in the zero position.



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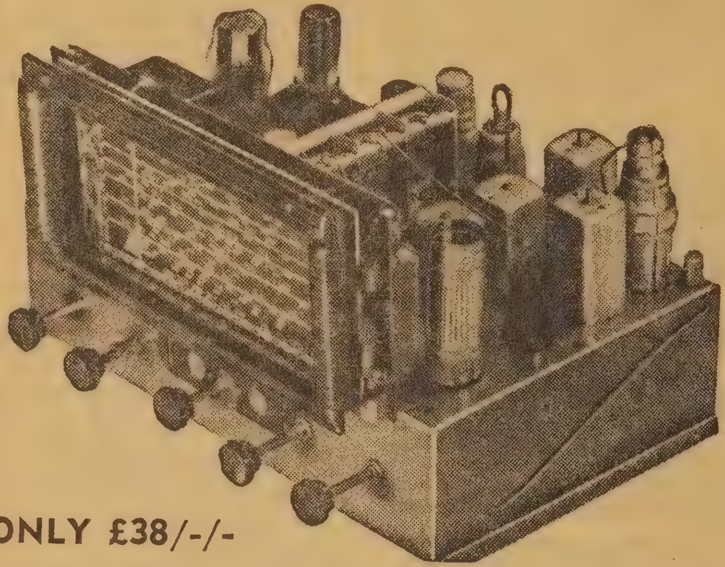

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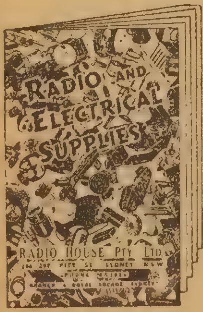

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bracket — see the photos — and the various resistors, &c. just naturally find themselves near a suitable tie-point. Some of them can sit along the outside of the strips. The two decoupling electros I tucked in just over the volume control. The midget 25 mfds electros have plenty of room at the end of the bracket. I used half-watt resistors of a good make throughout in the interests of space-saving. Similarly, there are some very nice miniature mica and tubular condensers which are easy to fit in. Note that the .04 mfds are actually two .02's paralleled.

MILLER EFFECT

The Miller effect associated with the volume control will reduce the response at 10 kc by up to 3db with the control half-volume. If you want to be particular, a 25 pf condenser wired as per circuit will restore it, but it's doubtful whether you'll notice the effect except by measurement. I don't care for this connection, although it is often used.

I brought the shielded leads for pickup and microphone through the back of the cover. A better scheme, at least, for the microphone, is to wire a standard mike connector socket to the end of the lead and screw it into a hole in the cover, leaving the lead just long enough for the purpose when the unit is pushed into the case. This is neater, but just a bit more awkward to arrange. Incidentally, the various leads to the unit are soldered to the appropriate points on the five and six pin valve socket and left just long enough to solder to the anchor points of the unit (actually, lugs on the terminal strips) as the unit is pushed into place. It's a good plan, to enclose the shielded leads in spaghetti to make sure they don't accidentally short-circuit a voltage point as you close up the unit in the case.

Remember that for six-volt operation pins four and five of each 12AT7 socket are connected together as one terminal, and pin nine used as the other. These valves are suitable either for six or 12 volt use.

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3 1000 ohms, 2 .01 meg, 1 .015 meg, 1 .03 meg, 5 .05 meg, 3 .2 meg, 2 1 meg, 1 5 meg—all ½ watt.

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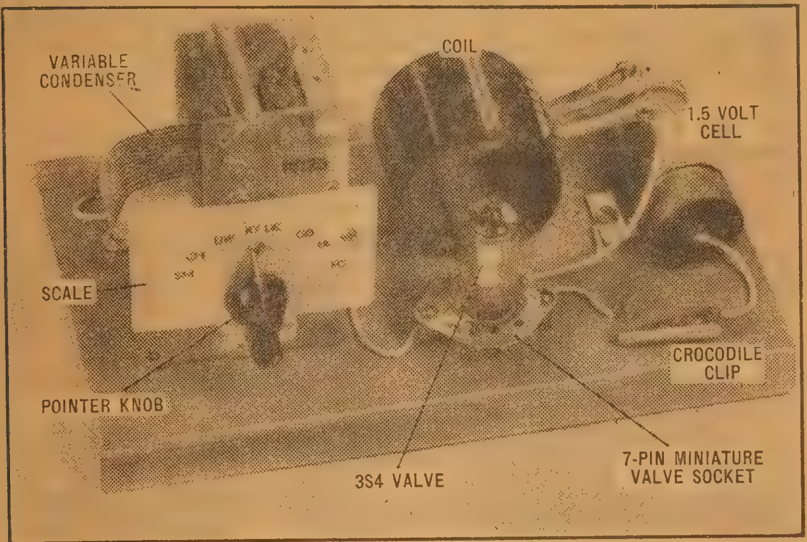
4 8-tag mounting strips, 4 knobs, shielded hook-up wire, hook-up wire, nuts, bolts, solder &c.

Teach Yourself Radio (3)

DON'T BE SCARED OF VALVES!

This month you meet for the first time what will soon be an old friend, a radio valve. We tell you quite a lot about how it works and what it can do. On the practical side, we show you how to connect a valve into a simple radio receiver. Read on! You are about to have fun!

by Maurice Findlay



The 3S4 valve, which replaces the crystal in this month's receiver, can be seen in front of the coil. The 1.5 volt cell is mounted on the right hand side. Even if you do happen to make a wrong connection there is no possibility of damaging the valve.

RADIO valves are really only a development of the familiar electric light globe. As you know, an ordinary electric light globe has a filament of fine tungsten wire enclosed in a glass envelope, from which the air has been removed. Wires are connected and sealed in the glass in such a way that it is possible to make contact with either end of the tungsten filament without allowing air to get in.

If air were to get into the envelope the fine tungsten wire would soon burn away when heated to a sufficiently high temperature.

HEATS FILAMENT

If a battery be connected, one terminal to either end of the filament, so that an electric current flows through it, heat will be produced. If the current is small, the heat may only be sufficient to cause the filament to get warm. However, if the current is increased, the temperature of the filament may increase until it is red hot. If sufficient current is used the filament can be made white hot, when it will produce a large amount of light as well as heat.

The metal tungsten is able to withstand very high temperatures without melting. This is why it is useful for electric light globes.

Just to make sure that you fully understand about electric light globes, have a good look at one, also a torch globe, and note the features of its construction.

It was during one of his experiments with electric light globes that the famous inventor, Thomas Edison, hit upon the basis of the modern radio valve. In the case of one of his "incandescent lamps," as they were called, he placed a metal plate inside the same glass envelop as the filament. A wire was connected to the plate so that it could be connected to an external circuit.

He found that an electric current could be made to flow between the filament and the metal plate, provided it were suitably connected. Thus, the seemingly empty space between the filament and the plate could be made a conductor of electricity. It does seem very strange, doesn't it?

A further important fact about the device is that it will only allow the current to flow if it is connected in one particular polarity. That is, connect the battery one way around and a current will flow. Reverse the battery and there will be no current flowing. You will remember that the crystal detector has the same important property of allowing current to flow in one direction only, and how we used a crystal to detect radio signals. This same property of the valve allows it to be used in place of the crystal detector in a simple receiver, but more of that later.

CURRENT FLOW

By the way, you will see now why it is called a valve. In the same way as mechanical valves control the flow of liquids, &c., the radio valve controls the flow of electric currents.

For the sake of convenience we generally do not draw radio valves as they actually appear in real life. It would take much too long and the finished result would be more difficult to understand than the system of symbols employed in engineers' drawings.

In Fig. 1a we have drawn the usual symbol used to represent a diode valve. It is called a diode because it has two elements or electrodes. The glass envelope is represented by an oval, a thick line is used to represent the plate, while the filament is shown as a thin semi-circle connected to the outside of the envelope by a pair of wires.

OTHER ELECTRODES

Some radio valves have one or more electrodes in addition to the plate and filament and other symbols are used to indicate the presence of these. If there are three electrodes the valve is called a triode, a four electrode valve is called a tetrode, a five electrode valve a pentode and so on. You will meet all these valves and understand how they operate as you progress and build larger receivers.

At Fig. 1b we have drawn the symbol for an electric cell and shown it connected to the filament of a valve. The symbol for the electric cell consist of two lines drawn paral-

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lel to one another. The long thin line represents the positive terminal of the cell and the short thick line the negative terminal.

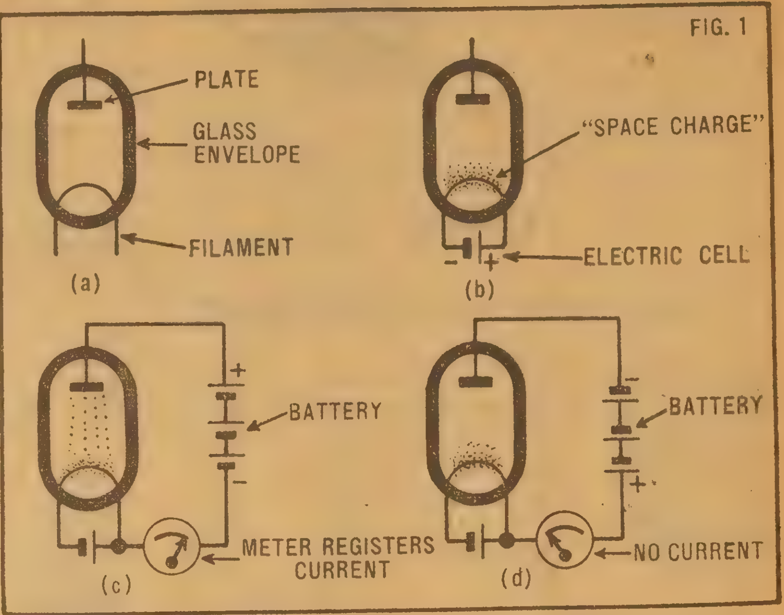
This is where we come to the explanation for the valve conducting electric currents in one direction, but not in the other.

When the filament is heated, tiny particles of negative electricity called electrons leave it and go out into the surrounding space. This leaves the filament with a deficiency of electrons, or a positive electric charge.

One of the important things about electricity is that positive and negative electric charges attract each other so that soon after they leave, the negative electrons try to return to the filament again. The result is that the electrons are continually leaving the filament and returning again, and there is a cloud of electrons, known as a "space charge," surrounding the filament when it is heated.

HOW A RADIO VALVE WORKS

FIG. 1



A radio valve allows the electrons to flow in one direction but not in the other. It is this property which enables it to replace a crystal detector in a radio receiver. There are more complicated types of valves than the one shown, but these will come later.

POSITIVE CHARGE

Not only are the electrons attracted to the filament but, if it is given a positive charge, some of the electrons can be attracted to the metal plate inside the valve. The plate is generally given a positive charge by connecting a battery of cells as shown in Fig. 1c.

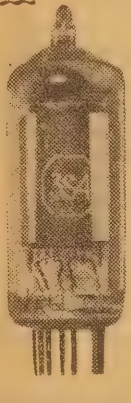
The electric current (or flow of electrons, which is just the same thing!) which flows in the plate circuit will be registered by the meter connected as in the diagram. If the number of cells in the battery is increased, the current registered by the meter will increase also. In fact, it will increase almost in direct proportion to the voltage of the battery until eventually, with a very large number of cells, a stage is reached when the filament can no longer supply a sufficient number of electrons.

If the polarity of the battery in the plate circuit is reversed as shown in Fig. 1d, the electrons will not be attracted to the plate because it is negative with respect to the filament, and no current will be registered by the meter.

☆

The picture of the 3S4 valve is reproduced full size. In addition to the plate and filament, it has two other electrodes which we will use in next month's set.

☆



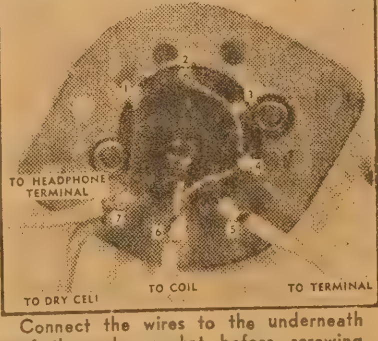
The diode valve may be substituted directly for the crystal detector used in the simple receiver described last month simply by connecting the plate to one of the wires previously going to the crystal and the filament to the other. At the same time, of course, it is necessary to connect a cell to heat the filament so that it can emit electrons.

This is exactly what we do in the set described this month.

The valve we have used is one of the latest miniature types which is given the distinguishing number 3S4 by the manufacturers. It has two electrodes besides the plate and filament, and we will use these when we build a more advanced receiver. The 3S4 behaves in exactly the same way as a diode when it is connected as shown in the photographs, so that you are saved the expense of buying a valve that you will not need later on.

The filament of the 3S4 is not of pure tungsten, as in the case of an electric light globe. Rather it has a special coating which allows it to emit electrons even though it be heated only to a dull red heat. This is a big advantage, because it means that a relatively small amount of power is required from the filament battery.

As a matter of fact, modern valves similar to the 3S4 are so economical that they will work for a good many hours on a single torch cell. We have suggested an ordinary torch cell in this case, because you will probably have had all the use of the set you need before the cell is exhausted.



Connect the wires to the underneath of the valve socket before screwing it in place. Fine tinned copper wire is used to interconnect the lugs of the socket and plastic covered hook-up wire for the four connections to other parts of the set.

When you take the valve out of its packet and examine it, you will note that externally it is a glass tube. One end has a tip of glass where the air was drawn out and the valve sealed during manufacture. At the other end are seven leads, set in the glass envelope, which form the base of the valve so that it can be plugged into the corresponding socket in the receiver.

BASE PINS

The leads forming the pins of the base are not evenly spaced but rather there is one gap between the pins which is greater than the remainder. This is done so that there is no possibility of its being plugged in incorrectly.

The pins are numbered in a standard way so that the connection can easily be identified. If you hold the valve so that you are looking down on the pins and with the space between the pins toward you, the pin immediately to the left of the space is pin 1. The rest of the pins are then counted until you come to pin 7, which is on the right of the space. Check with the layout diagram if you are not perfectly sure.

The base of the 3S4 fits into a standard seven-contact miniature socket. You will be able to buy one of several types at any radio supply store. However, the type we suggest for this set is mounted on a metal plate about 1½in in diameter. This allows it to be placed on a pair of stand-offs as shown in the photo-

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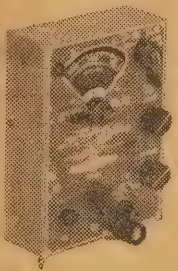

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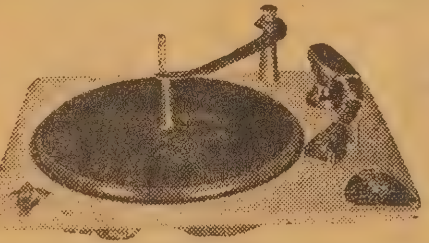

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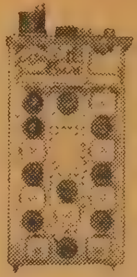

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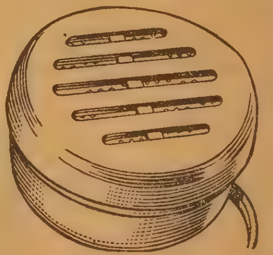

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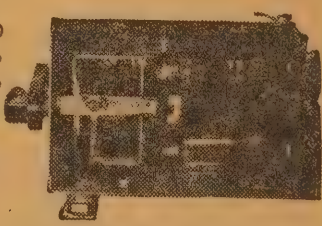


METROPOLITAN RADIO SUPPLIES

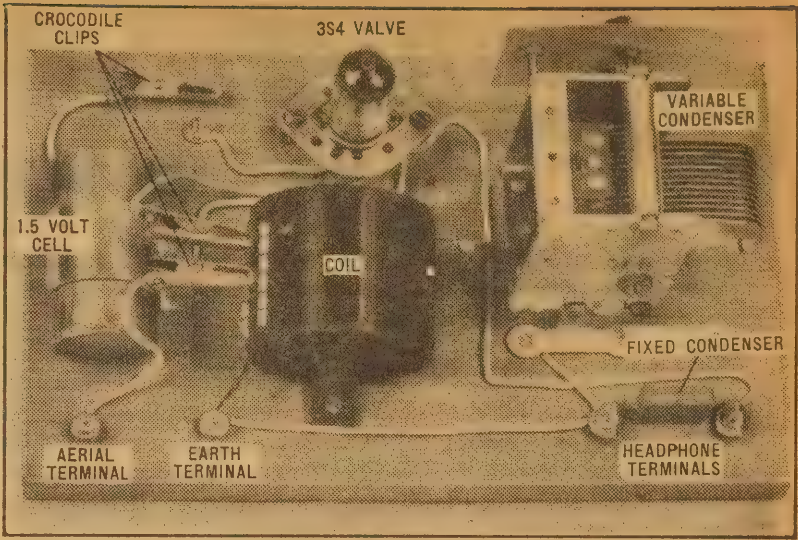
479 PARRAMATTA RD., LEICHHARDT, N.S.W. PHONE LM3610.
(AT TOP OF TAVERNERS HILL)

graphs. The stand-offs have holes drilled through them so that the socket can be supported by passing a pair of wood screws through the holes in the metal plate, through the stand-offs and into the wooden baseboard.

Besides the valve, you will need to mount a torch cell and a terminal post on the baseboard. There is room for everything without shifting any of the original parts, but to make the layout more even, we did move the coil a little to the left.

The torch cell is mounted on the right-hand side of the baseboard. It is held in place by means of a wood screw and a metal clip, which can be manufactured from any piece of scrap metal of about 18-gauge.

Before mounting the cell, slide off the cardboard cover so that the clip can make contact with the metal container, which is actually the negative terminal of the cell. The wire to the valve can then be connected by pressing it between the clip and the wooden baseboard as it is screwed down.



The rear picture of the receiver shows all the major parts. The on/off "switch" at the top left consists of a crocodile clip and a terminal post.

PARTS LIST

Most of the parts are the same as used last month.
Wooden baseboard 9in x 5½in x ¾in.
Fixed condenser (.001 mfd.)
Variable condenser (.0004 mfd, approx.)
Headphones
2 Crocodile clips
Coil former (2in length of 2in diam.)
Bakelite strip 3in x ½in x 1/16in
7 ⅛in diam. bolts, 1in long
14 ⅛in nuts
18 ⅛in washers
6 small wood screws
In addition to the above you will need these parts to build the diode valve receiver.
1 3S4 valve
1 7-pin miniature valve socket (with mounting plate)
1 1.5 volt torch cell
Scrap metal for mounting clip
1 Crocodile clip (extra)
3 Wood screws 1in long
2 Stand-offs (about ⅝in long)
Tinned copper wire, solder flux etc.

Switches are fairly expensive these days and a switch which would be suitable for this set may not be suitable for the set you will build later on, so we have suggested that you use an ordinary crocodile clip to complete the filament circuit. Clip it to the 1-8in bolt when you want to listen in and remove it to save the dry cell when the set is not in use.

Unlike the crystal set, the diode receiver requires power for its operation and, therefore, cannot be left on all the time, unless, of course, you have a fortune to spend on dry cells.

The energy taken from the dry cell does not help to operate the headphones. It is merely used to heat the filament of the valve so that it can emit electrons. As a matter of fact the new receiver is exactly like the crystal set except that the diode valve is used in place of the crystal detector.

Because the radio energy picked up by the aerial is all that is available to drive the headphones, there is no reason why the signals should be any louder than with the crystal detector. If you are using a good pair of high resistance phones, the signals will be about the same, but with a pair of low resistance phones the signals may actually be louder with the crystal.

The main reason for trying the valve instead of the crystal in this way is for you to get used to using valves and particularly to get some practice in soldering fine wires, before going on to more complicated sets.

If you haven't had any practice at soldering it may be a good idea to try soldering a few wires before starting on the set. It is essential that you be good at soldering if you wish to make radio a hobby because it is the only really satisfactory way of making most of the connections in modern complicated receivers.

You will need a soldering "iron" of some sort. It consists essentially of a copper bit and may be of the type which is heated in a gas flame, or, if you are more fortunate, an electric soldering iron is cleaner and easier to use. It keeps constantly at the required temperature and requires very little attention in use.

We find that an iron rated at about 60 watts is best for most radio work. Some control over the temperature of an electric soldering iron can be had by sliding the bit in and out. If the tip becomes too hot, undo the holding screw and slide it out a little. If it does not get sufficiently hot try the reverse.

You will soon get an idea of how much heat is required. If the temperature is too low the solder will not flow easily, while if it is too high it will take on a gritty appearance.

Solder by the way is an alloy of two metals, tin and lead. For radio work it is best to use solder with about 60 pc tin and 40 pc lead, although equal quantities of tin and lead also make an excellent solder. The solder which contains a greater proportion of lead than tin melts at a high temperature. It is often used by plumbers, but is not suitable for radio and electrical work.

SOLDERING FLUX

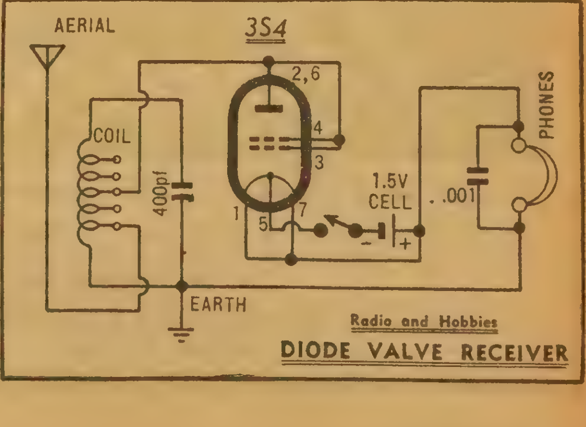
Besides the soldering iron and solder, you will need a flux of some kind. Solder designed especially for radio work comes in the form of a wire which contains a core of resin and where you are soldering new and shiny parts, this is all that is needed. If you do not have resin cored solder, one of the non-corrosive paste fluxes may be used. Apply only a smear to the parts to be soldered. A small tin of flux will last a busy radioman for years.

On no account use killed spirits or spirits of salts because both, and

☆

After last month's experience you should be able to read the schematic circuit without too much trouble. The plate, screen and grid of the 3S4 are connected together here but we will use them separately later.

☆



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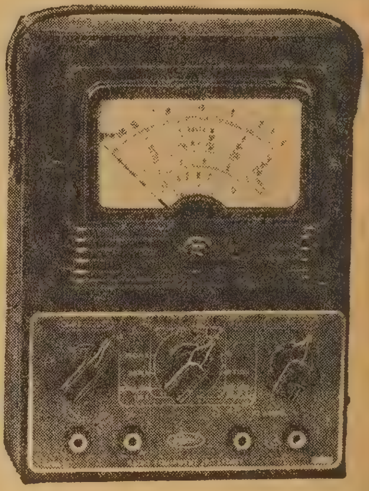
MULTIMETER MODEL MVA/2

This latest model MVA/2 covers all modern requirements and can be used as a portable instrument or on the bench. Its extensive use in Australia, New Zealand, the Near East, and the Pacific is a pointer to its efficient performance. It is entirely self-contained and is supplied with test leads and instructions. D.C. current can be extended up to 50 amperes with external shunts, and A.C. current ranges can be provided up to 10 amperes with current type transformer type MRCT.



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The following ranges are provided—D.C. Volts: 0-10, 0-50, 0-250, 0-500 all with a sensitivity of 1000 ohms per volt. The D.C. Milliamp ranges are: 0-1, 0-10, 0-50, 0-250. Ohmmeter ranges are Zero to 1000 ohms, and Zero to 100,000 ohms. Resistance values as low as .25 ohms can be measured on the low scale.

The various ranges are selected by means of a foolproof switching system which prevents changes in accuracy due to normal wear and contact resistance of the switches. The indicating instrument fitted to the Model D.C.M. is the well-known "University" Model F3, round an accurately calibrated and easily-read type, 3½ inch diameter meter, fitted with scale.

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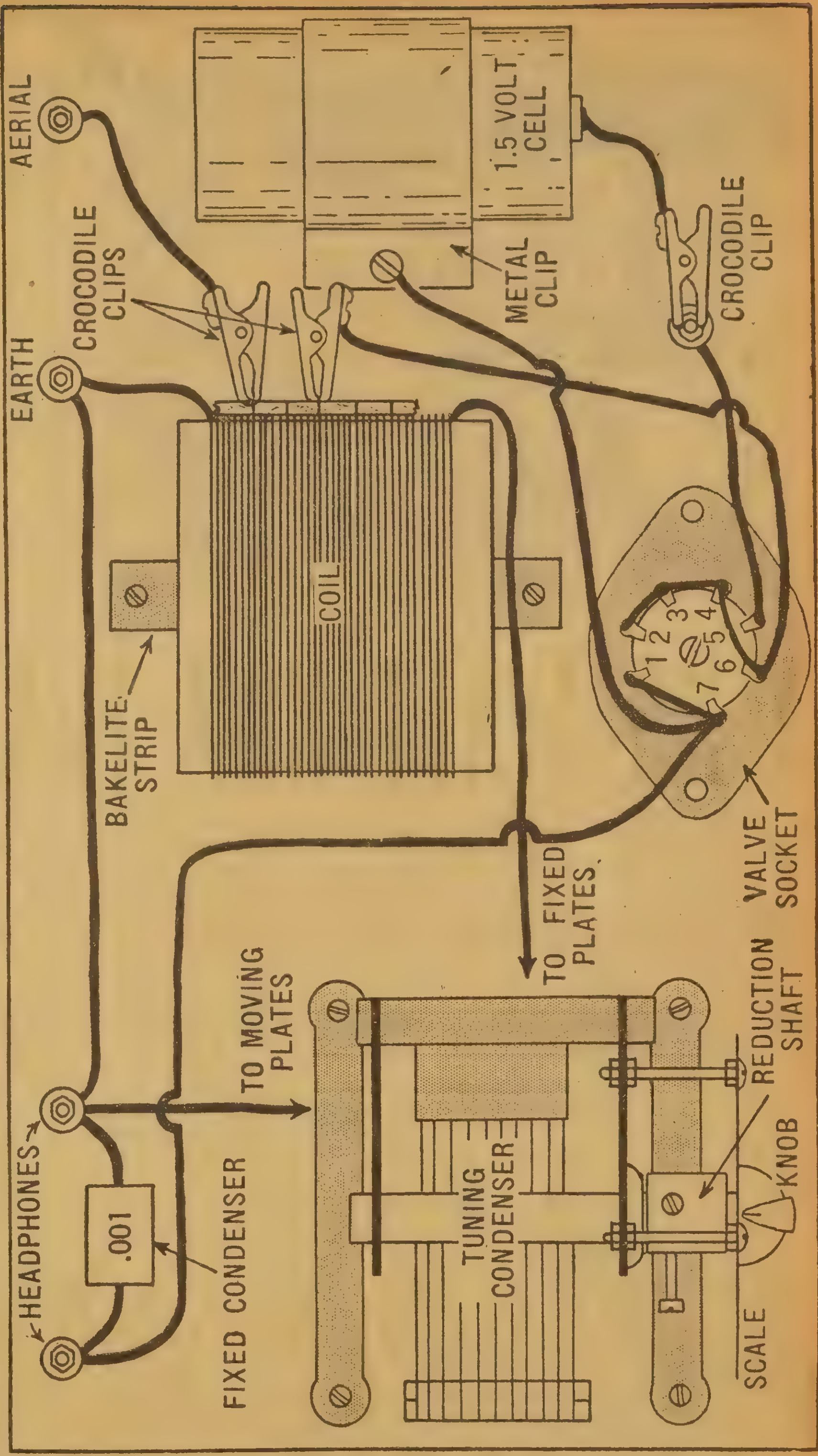


This layout diagram is drawn full size. The valve socket is drawn upside down. When the wiring is complete you can turn the socket the right side up and screw it in place.

especially the latter, are highly corrosive.

When you are ready to solder and have the iron heated to the correct temperature, the first thing to do is to make sure that the iron is correctly "tinned." By this we mean that it should have a shiny coating of solder over the part of the bit which you will use to apply the heat. If it is dirty, you will need to rub the scale off with a file. Then rub it with flux smeared on an old piece of rag and finally melt some solder so that it covers the working surfaces. If you have resin cored solder you can sometimes get a good tin simply by rubbing the solder over the bit after it has been filed clean.

If the parts you are to join are new and clean, no special preparation will be required. Simply hold them together, smear a little flux over them and apply the soldering iron, which you have previously provided with a blob of solder.

Allow a few seconds for the parts of the joint to reach the melting point of the solder, otherwise the two parts of the joint will not be tinned properly as is required for a good connection.

WITH NEW PARTS

With resin cored solder and new and shiny parts simply place the end of a length of solder over the joint and apply the iron. As the solder melts, the flux will flow over the parts and ensure a good joint.

Don't forget to scrape off the enamel before attempting to solder enamel covered wire. Also if you are soldering parts which are old and corroded, it will be necessary to scrape them with a knife or clean with emery cloth if a good connection is to be made.

You will need to use judgment when soldering the new plastic covered hook-up wire. Leave the soldering iron in contact with the joint only long enough to ensure a good connection. Too much heat will cause the plastic insulation to melt.

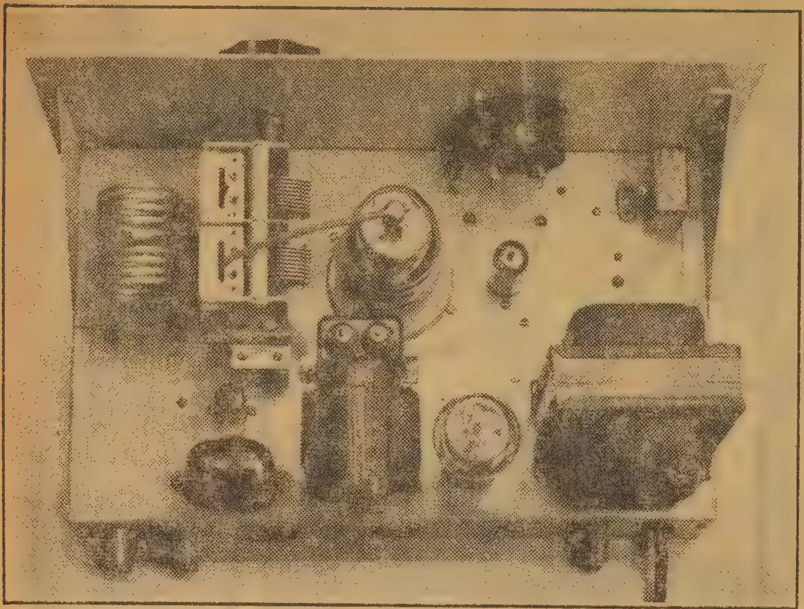
Most of the solder connections in this set are to the valve socket, and these are best done before it is screwed to the baseboard.

Checking with the photograph of the underneath of the socket you will see that pins 1 and 7 are joined together with a piece of tinned copper wire and likewise pins 2, 3, 4, and 6. Take care that the wire joining the latter does not touch pin 5. Having made the interconnections on the socket, you can attach the four wires which do to other parts of the circuit. Make them longer than you anticipate will be necessary because it is easy to cut them to the correct length after the socket has been screwed in place.

With the set wired up, you will find that it behaves in much the same way as the crystal set. The only energy available to operate the diaphragms of the headphones is that which comes from the aerial just the same as before. The valve does have a slightly different characteristic to the crystal and you may find that you get optimum results with the crocodile clip which goes to the plate of the diode higher up the coil than was the case with the crystal detector. However, you can experiment to find the best setting for your own particular case.

When the other electrodes in the valve are used, it is possible to amplify the signals from the aerial and further, the energy which drives the headphones can come from a battery. As a matter of fact, it is possible to amplify the minute signal from the aerial to the point where it is capable of operating at loudspeaker.

We will tell you more about valves next month and describe a receiver which uses a valve as an amplifier



A rear view of the transmitter chassis. The crystal is at the top right, 6BW6 behind the meter. Note the shield around the 807 base. Power supply components are along the rear edge, with tone monitor behind the gang. The space behind the final tank is available to mount a multiple relay, should this method of control be adopted.

A 35-WATT 807 TRANSMITTER

A development of the 5-band transmitter recently described in Radio and Hobbies, our new transmitter has an efficinet 35 watts input. Full advantage of the high power sensitivity of the 807 beam tetrode is obtained without instability troubles. The companion modulator uses 6BW6's operating in class AB2. No hard-to-get components are required in either transmitter or modulator.

by Maurice Findlay

THE 6V6/807 type of transmitter has long been a favorite with amateurs and for several good reasons. The 6V6, or its later miniature equivalent, the 6BW6, makes an excellent crystal oscillator and in the familiar tritet circuit is capable of delivering sufficient output to drive an 807 up to the 4th harmonic of the crystal. Thus, with a 3.5 and 7.0 Mc crystal, it is possible to operate on all five bands between 3.5 and 28 Mc.

There is a reserve of drive in all cases as, even when quadrupling from a 3.5 Mc crystal to 14 Mc, there is 4 mA available and 3.5 mA when quadrupling from 7.0 to 28 Mc. This allows a comfortable reserve over the minimum of about 3.0 mA required for the 807 in this particular case. Provided the cathode coils of the tritet circuit are correctly adjusted the crystal current is well within the allowable limits.

MODERATE DRIVE

Allowing for the inevitable circuit losses, the total driving power required for the 807 is less than 1 watt compared with 5 or 6 watts required to drive a comparable triode. Had a triode been used in this transmitter instead of a beam teterode, at least one extra stage would have been required.

There is a catch, however. The very feature which makes the 807 so attractive, namely the high power sensitivity, makes it necessary to take special precautions to prevent energy being fed from the plate circuit into the grid circuit in such a way as to cause oscilaltion. The 807 has a transconductance of 6 mA/volt, so that the amount of grid to plate coupling required to cause oscillation is very small indeed.

As many amateurs know to their cost, 807's will not behave themselves in the approved manner unless certain precautions are taken with the layout.

In several designs published in Radio and Hobbies we have adopted the procedure of laying the 807 on its side, thereby ensuring the maximum possible isolation between input and output circuits. While this is an excellent basis for design, there are times when it is more convenient for various reasons to mount the valve in the conventional vertical position. Such a case is the present transmitter.

One way of achieving complete stability with the valve mounted in any position is to employ neutralisation. The arrangement is identical with that adopted for the 6BW6 previously, except that the grid-to-plate capacitance and hence the value of capacitance required for neutralisation of the 807 is much lower.

In addition to neutralisation, the usual precautions against parasitic oscillation at VHF are included in our new circuit. These are a 50 ohm ½ watt resistor wired between the screen pin and the bypass condenser and a choke consisting of about 12 turns of 18 gauge wire closewound ¼in diameter and self-supporting. Neither component appears to be very critical.

A final precaution recommended by the manufacturers is to place a shield around the lower portion of the 807, reaching up as far as the bottom of the plate. The same results are sometimes achieved by mounting the socket below the level of the chassis.

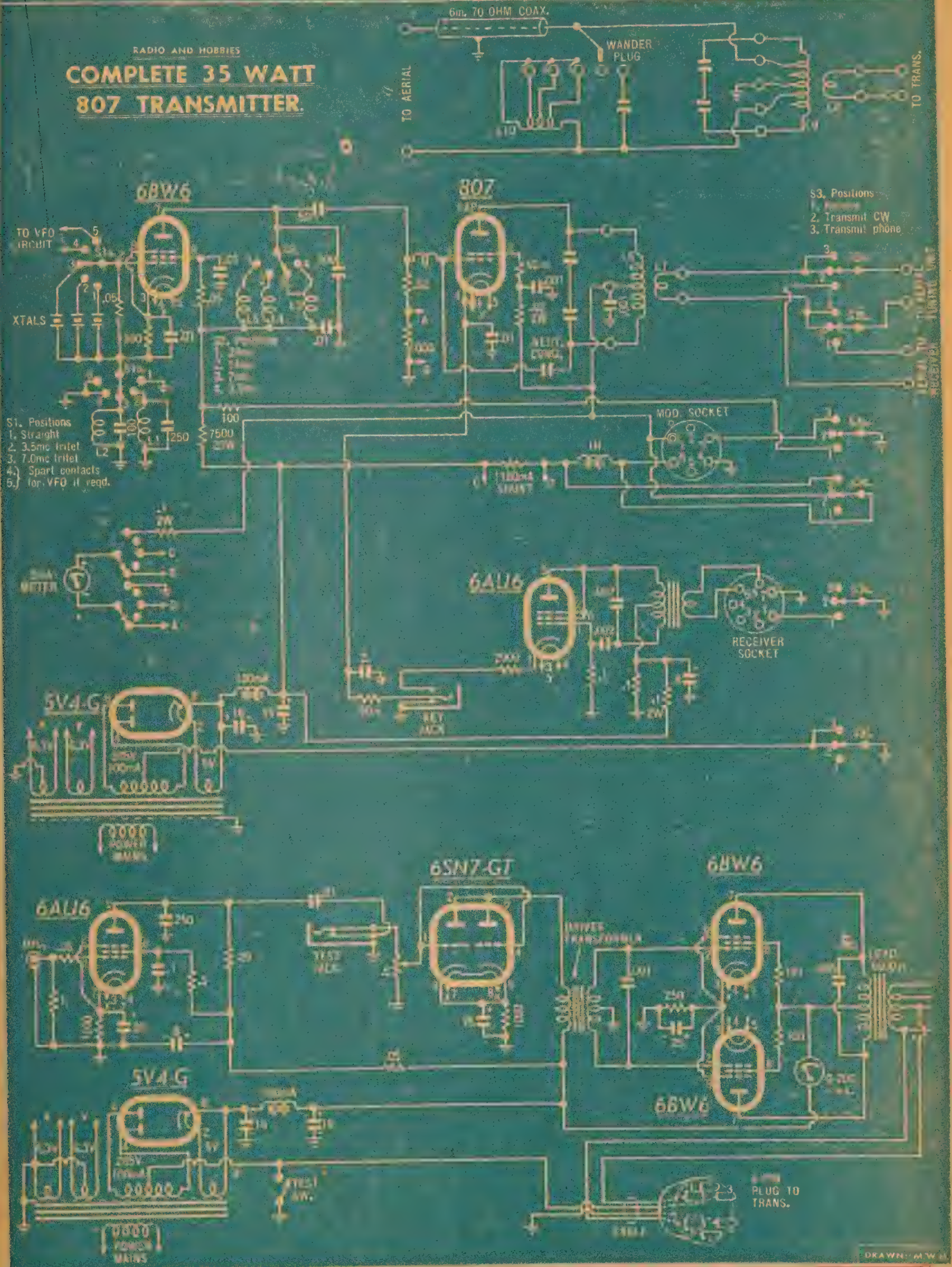
QUITE STABLE

With the transmitter correctly neutralised, it is possible to tune both plate and grid circuit to resonance on 28 Mc and then remove the crystal without any sign of oscillation, as indicated by a reading of grid current in the 807. This test is rather brutal as regards the 807, but justified in our case where it is desired to make absolutely certain that all is in order.

A standard 385 volt 100 mA transformer, a 5V4-G rectifier and a condenser input filter, allow a high tension voltage of 450 to be obtained under full load conditions. With 450 volts applied, the 807 can be loaded to 80 mA plate current with good efficiency. The inpute works out to 36 watts.

Working on the basis of the available 450 volts, the screen dropping

TRANSMITTER, MODULATOR AND AERIAL TUNER


RADIO AND HOBBIES
COMPLETE 35 WATT
807 TRANSMITTER.
6in. 70 OHM COAX.
TO AERIAL
WANDER PLUG
TO TRANS.
6BW6
807
TO VFO CIRCUIT
XTALS
.05
S1. Positions
1. Straight
2. 3.5mc tritet
3. 7.0mc tritet
4.} Spart contacts
5.} for VFO if reqd.
L2
L1
250
100
7500
10W
S3. Positions
2. Transmit CW
3. Transmit phone
NEUT. COND.
MOD. SOCKET
METER
6AU6
RECEIVER SOCKET
KEY JACK
5V4-G
POWER MAINS
6AU6
6SN7-GT
TEST JACK
DRIVER TRANSFORMER
6BW6
6BW6
5V4-G
TEST SW.
PLUG TO TRANS.
DRAWN: M.W.H.

A lot of circuit in one piece but not as difficult as it may appear at first glance. The aerial tuning unit, as already described is at the top, the transmitter proper below it. The 6AU6 in the centre is an optional tone monitor stage. At the bottom is the modulator. Lower powered versions of the same units have been described in recent issues.

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P.A. RANGE 50-8000 cps Output to Voice Coil

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	12.5, 8, 2.3	64/3		OP-1
10	5000, 2500 SE	5, 2.7	65/4		OP-33
10	5500 SE	3.7	72/1		OP-41
10	30,000 20,000 14,000 10,000, 7000, 5000, 2500 PP	2.3	65/2	Universal Test Loud Speaker	OP-53
10	5000, 2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	72/1		OP-54
10	5000, 2500 SE	15.	65/4		OP-39
10	10,000 PP	15, 8.4, 2.3	72/1	5W Cath Amplifier	OP-85
10	7000 PP	Any ONE of following impedances—15, 12.5, 8.4, 2.3, 2.	72/1	9W Cath Amplifier	OP-92
15	5000 PP	12.5, 8, 2.3.	99/1		OP-2
15	6600 PP	12.5, 8, 2.3.	99/1		OP-3
15	10,000 PP	12.5, 8, 2.3.	99/1		OP-4
15	10,000, 6600, 5000 PP	12.5, 8, 2.3.	99/1		OP-5
15	5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/6		OP-55
15	6600 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2	105/6		OP-56
15	10,000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	105/6		OP-57
15	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	106/8		OP-58
25	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	133/10		OP-59
32	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.	171/-		OP-60
60	3800 PP	17.6	166/8		OP-36
60	3800 PP	100, 75, 50, 25, 10, 5, 2.	195/5		OP-61

P.A. RANGE 50-8000 cps. Output to Line

Wts	Primary Impedance	Secondary Impedance	Retail Price	Special Application	Code No.
10	5000, 2500 SE	500	64/3		OP1A
10	5000, 2500 SE	500, 250, 125	74/3		OP-44
15	5000 PP	500, 250, 125	99/1		OP-6
15	6600 PP	500, 250, 125	99/1		OP-7
15	1000 PP	500, 250, 125	99/1		OP-8
15	10,000 PP	500, 250, 160, 125, 100, 83.5, 71.5, 62.5, 55.5, 50	117/4		OP-8M
15	10,000, 6600, 5000 PP	500, 250, 125	99/1		OP-9
15	5000 PP	600, 300, 200, 150, 130, 100, 75, 50	114/10		OP-34
15	8000 PP	600, 300, 120, 60, 30	199/10		OP-50
25	5000 PP	500, 250, 125	119/7		OP-10
25	6600 PP	500, 250, 125	119/7		OP-11
25	10,000 PP	500 250 125	119/7		OP-12

P.A. RANGE Cont.

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
25	10,000, 6600, 5000 PP	500, 250, 125	119/7		OP-13
25	10,000 6600 PP	500 4000, 8.4 2.2	164/1	Cutting and Playback Amplifier	OP-35
25	6600 PP	600, 300, 250, 200, 170, 150, 76, 50, 36, 27, 12.5, 7.5, 3.6, 2.7	199/10		OP-38
32	5000 PP	500, 250, 125	144/11		OP-14
32	6600 PP	500, 250, 125	144/11		OP-15
32	6600 PP	500, 250, 166, 125, 100, 83 5, 71.5, 62.5 55.5, 50	148/9		OP-15M
32	10,000 PP	500, 250, 125	144/11		OP-16
32	10,000, 6600 5000 PP	500 250 125	144/11		OP-17
32	6600 PP	140, 70	171/-		OP-48
60	3800 PP	500, 250, 125	168/8		OP-18
60	3800 PP	100, 75, 50, 10, 5, 2	195/5		OP-61
80	6400 PP	500, 250, 125	207/-		OP-37
105	8800, 6000 PP	500	299/-		OP-49
150	11,600 8400 PP	500 250, 166 125	384/1		OP-20

HI-FI RANGE 30-15000 cps. Output to Voice Co

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
5	5000 SE	Any ONE of the following impedances 15, 12.5, 8.4, 6.5, 2.1	67/6	4W Baby Playmaster	OP-24
10	3250 SE	12.5, 8.4, 2.3	101/2	R & H Vox Major	OP-23
10	5000 SE	2	92/-	For Rola 120x Speaker	OP-113
10	5000 PP	2	92/-	For Rola 120x Speaker	OP-117
10	6600 PP	2	92/-	For Rola 120x Speaker	OP-119
10	8000 PP	2	92/-	For Rola 120x Speaker	OP-118
10	10,000 PP	2	92/-	For Rola 120x Speaker	OP-112
15	5000 PP	12.5, 8, 2.3	147/2		OP-19A
15	10,000 PP	15, 3.75	152/11	10W Playmaster	OP-63
15	10,000 PP	12.5, 3.125	152/11		OP-64
15	10,000 PP	8.4, 2.1	152/11		OP-65
20	4500 PP	15.5, 12.5, 8.6, 2.7, 2	134/4	15 & 32W Cathamplifiers	OP-51

Output to line

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
10	3250 SE	500, 250, 125	101/2		OP-22
15	5000 PP	500, 250, 125	147/2		OP-19B
15	10,000 PP	500, 125	152/11		OP-62

SPECIAL HI-FI RANGE 20-30,000 cps.

Wts	Primary Impedance	Secondary Impedance	Price Retail	Special Application	Code No.
15	10,000 PP	8.4, 2.1	180/11	For Williamson Amp.	OP25/8.4
15	10,000 PP	10, 2.5	180/11	For Williamson Amp.	OP25/10
15	10,000 PP	12, 3	180/11	For Williamson Amp.	OP25/12
15	10,000 PP	15, 3.75	180/11	For Williamson Amp.	OP25/15
15	10,000 PP	16, 4	180/11	For Williamson Amp.	OP25/16
15	10,000 PP	40, 10	180/11	For Williamson Amp.	OP25/40
15	10,000 PP	250, 62.5	180/11	For Williamson Amp.	OP25/25
15	10,000 PP	500, 125	180/11	For Williamson Amp.	OP25/50
15	5000 PP	8.4, 3.7	192/5		OP-66
15	5000 PP	15, 6.5	192/5		OP-67

ENGINEERED **TO-DAY** FOR **TO-MORROW'S** REQUIREMENTS resistor and the dropping resistor for the crystal oscillator valve can be calculated. You will note that the latter is higher than in the case of the 6BW6 transmitter, where the high tension voltage was somewhat lower.

Allowing for the power dissipated in the screen circuit of the 807, a total of about 20 watts of audio power is required to fully modulate the transmitter. There are several arrangements which would allow this amount of power to be developed but the most straightforward and least costly appears to be the arrangement adopted in the printed circuit.

A transformer is used to couple the grids of the 6BW6 output valves to the plate circuit of the driver valve. The transformer allows the drive to be applied to the valves and at the same time provides a low resistance path between the grids and earth. This means that the grids can be driven positive with respect to the cathode and grid current allowed to flow without the severe distortion that would be encountered with resistance coupling.

TYPE OF BIAS

For maximum output the manufacturers recommend that a fixed bias from batteries or some other low impedance source be applied to the valves and that the screen supply have very good regulation. Under optimum conditions 30 watts output can be obtained from 6V6-GT's or 6BW6's is class AB2. This is somewhat more than is required and adequate output can be obtained by means of a much simpler and cheaper arrangement.

To obtain the 30 watts output the plate supply is adjusted to 315 volts, the screen to 285 volts and a fixed bias of minus 19 volts applied to the grids.

In order to simplify the power supply arrangements both the plate and the screen are operated at 310 volts, in our case, this being the maximum screen voltage permitted by the manufacturers. Further, to avoid the need for batteries, which have to be replaced every so often, the bias is obtained from a resistor placed in the cathode circuit.

Under these conditions the valves are capable of delivering a steady sine wave output of 15 watts.

However, this is far from the full story. A quick check with the multimeter showed that at full output the high tension voltage had dropped considerably because of the increased drain on the power supply. At the same time the extra current through the valves had caused the bias to increase in proportion.

SPEECH CONDITIONS

We then checked the capabilities of the modulator, attached to the transmitter, with the aid of a cathode ray oscilloscope. It was then easy to demonstrate that under ordinary speech conditions the modulator is easily capable of modulating the transmitter.

As a matter of fact, during one test we adjusted the input to over 40 watts. It was still possible to exceed 100 pc modulation on peaks, indicating that the modulator is capable of delivering much more than 20 watts peak.

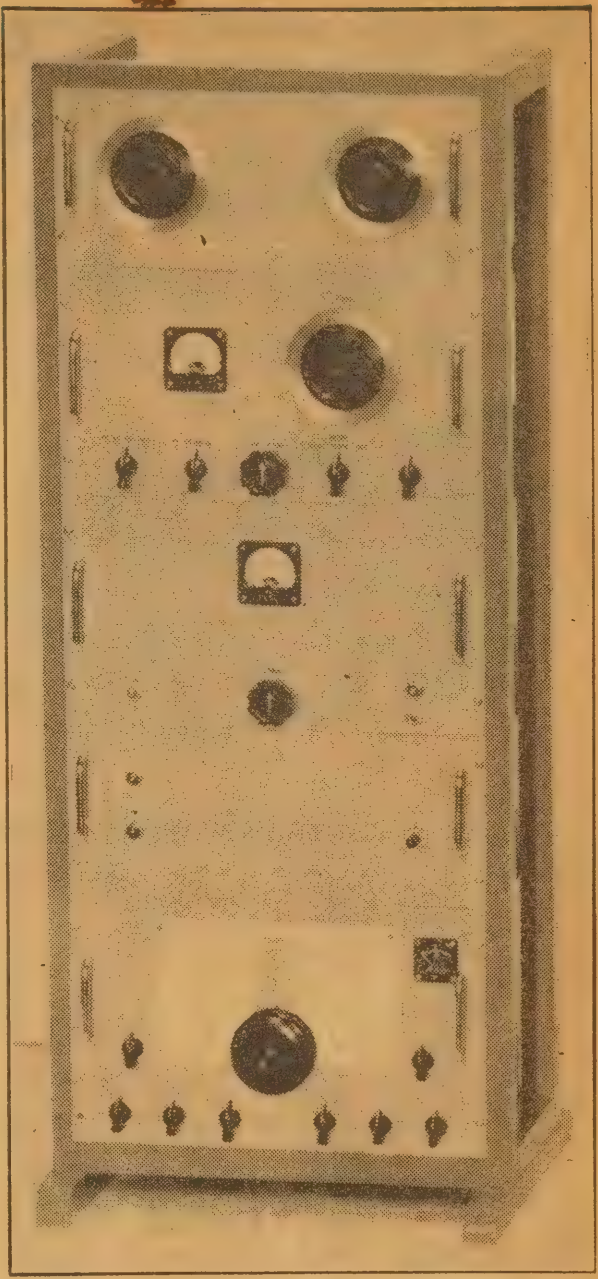
The reason for this, of course, is that the electrolytic condensers in the power supply and also shunting the bias resistor take a definite amount of time to discharge and change so that the valves are able to operate under favorable conditions long enough to handle the peaks of the speech.

With the oscilloscope attached and the transmitter feeding into an artificial aerial a series of sharp and smooth over-modulation patterns will be obtained if you speak into the microphone with the gain control fully advanced.

On the other hand, a continuous whistle into the microphone will merely overload the modulator itself without overmodulating the transmitter. Personally, we would be quite happy to use the modulator on any transmitter with 40 watts input or less, provided, of course, it is not required to transmit music or continuous tones.

If you have a strong opinion on this matter, by all means follow the manufacturers' recommendations. You will need 13 1.5 volt dry cells to obtain the required bias. Some changes to the power supply circuit will also be required because with fixed bias there will be an extra 19 volts applied to the valves, thereby exceeding the manufacturers' ratings. A voltage divider system could be used to obtain the screen supply.

You will note that we have included fairly heavy values of condensers in shunt with the secondary of the driver transformer and the primary of the output transformer. The object of these is to limit the high frequency response somewhat.



The complete transmitter and receiver installation, mounted in a wooden rack and finished off with grey lacquer and chrome handles. Overall height is just over 40 inches and suitable for table-top working. The aerial tuner is at the top, then the transmitter proper. Modulator is below this, then a spare panel, with the receiver at the bottom. Indicator bezels and key switch have been mounted on the spare panel for relay control purposes, while the writer visualises the possibility of installing a small VFO unit in the space between them.

* * *

The neut. condenser (shown here in full size) is made from polystyrene and scrap brass. Area of the plates adjacent to each other is $\frac{1}{4}$in square and neutralisation is achieved when they are approximately $\frac{1}{8}$in apart.

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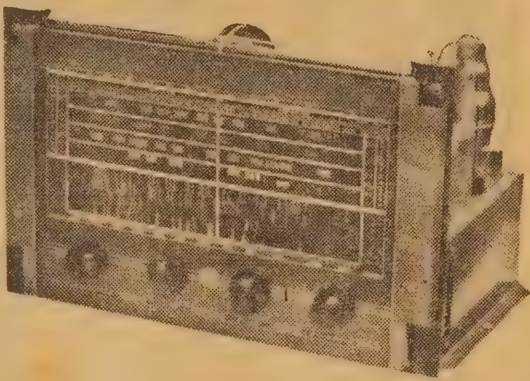

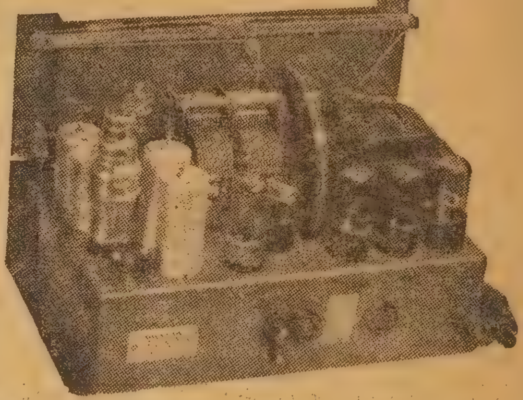

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- Power switch is fitted to the tone control of all chassis thus enabling the power to be completely switched off from the set. Radiogram switch combined with wave change switch.
- Tuning is made simple and positive even on overseas stations by the use of a super sensitive magic eye tuning indicator.
- All chassis are wired for the fitting of an F.M. or television tuner, special plug on back of chassis being provided, also standard 3-pin socket for power supply to motor.
- Speakers supplied are Magnavox 12in and 8in permanent magnet with tropic proof transformer. Single 12in supplied with 7 valve chassis.
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SPECIFICATIONS AS NINE VALVE UNIT, BUT WITH SINGLE 6V6GT OUTPUT VALVE AND SINGLE 12" SPEAKER.

THE NEW COLLARO 3RC521 CHANGER (3 SPEED)

This model supersedes the 3RC511 and includes many improvements the principle of which is an entirely new record-dropping mechanism designed to give certainty of operation without possibility of damaging records. Available with twin crystal heads (Acos GP27) or with high fidelity magnetic with matching transformer and fitted with twin point permanent stylus, pre-set speed regulator and record size to play nine 7", 10", or 12" discs. **£21/-/-** PLUS FREIGHT

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CLASSIC RADIO

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and at the same time obviate the possibility of parasitic oscillations. The usual grid stopping resistors are not included because they increase he resistance between the grid and arth, a very undesirable characteristic in this case.

The driver stage consists of a riode formed by connecting the two ections of the 6SN7-GT in parallel. This provides a reserve of driving power which is all to the good, especially when it can be had at such mall cost.

A 6AU6 is used as a microphone preamplifier driving the 6SN7-GT. ts plate and screen supplies are btained from a decoupling network n the usual way while a separate winding on the power transformer is used to supply the filament. In most cases best results will be obained with the centre tap of this winding earthed. However, if there s any sign of hum in your case, ry earthing either end of the winding instead of the centre tap. In ur case the hum level is negligible.

HIGH GAIN PREAMPLIFIER

A .05 meg ½ watt resistor is wired directly in series with the grid of he 6AU6, the object being to prevent RF feedback which sometimes akes place when high gain microphone preamplifiers are operated in he vicinity of RF fields. Again, here is no suspicion of any such rouble in the original transmitter.

To obviate hum and feedback rouble the grid return resistor, athode bias resistor and associated bypass condenser and the 8 mfd electrolytic which forms part of the decoupling network should be returned o a single point on the chassis, preerably near the 6AU6 socket. The hielded cable from the microphone ocket should also be returned to this point, which will mean in most cases hat the outside of the socket will have to be insulated from the chassis. Actually, all we have done is o apply the standard precautions equired for high gain microphone preamplifier stages

With the gain control advanced fully, the modulator will give full output with approx. 0.015 volts input. Since the average crystal microphone has an output of about 0.02 volts under ordinary close speaking conditions there is a handy reserve of gain.

BASS RESPONSE

Some control over the bass response of a crystal microphone can be had by varying the load resistor n this case the grid return resistor of the 6AU6. For full bass response the resistor may be as high as 5 megohms, but for communication work a load resistance in the vicinity of 1.0 meg. will give a desirable characteristic. Some amateurs like the effect of reducing the load resistor to 0.5 meg.

The transmitter, modulator and receiver power supplies and also the aerial changeover arrangements are made by the three position function switch mounted at the right hand side of the transmitter panel. A 2 bank, 3 pole, 3 position switch is required, preferably with non-shorting contacts.

If you examine the circuit you will note that, in addition to power supply switching, the function switch shorts the modulation transformer for CW transmissions and shorts the click filter choke for phone. Further, a heavy bleed is placed across the power suply for the crystal oscillator with the switch in the "receive" position in order to silence the transmitter immediately. This is particularly important when you happen to be transmitting and receiving on the same frequency.

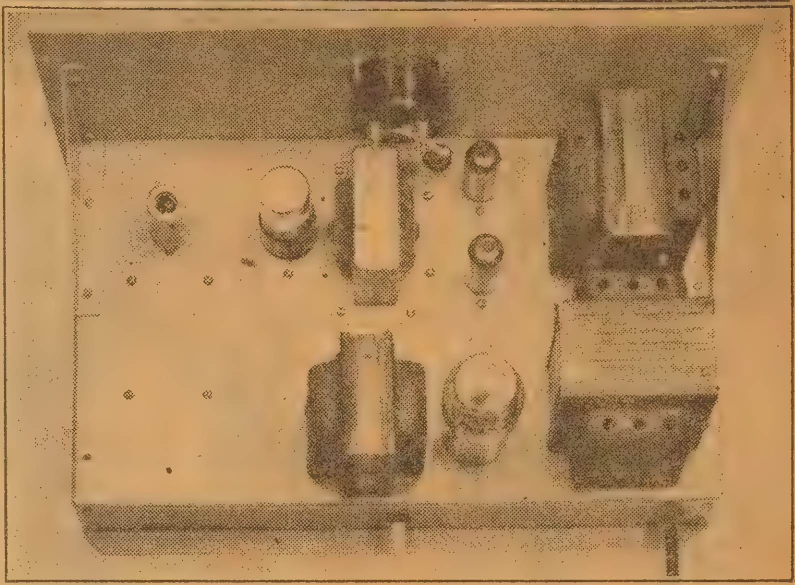
With condenser input to the filter in the case of the transmitter power supply, one section of the switch is handling about as much as could be expected of it. For this reason it is highly desirable that the switch should be turned smartly from one position to the other. With wafer switches, particularly where the clicker plate mechanism is lacking in tension it is possible to change slowly. This may result in an arc which will reduce the life of the contacts.

Some amateurs will have relays suitable for the changeover operation among their stocks of parts. At various times there have been literally dozens of types of excellent relays available from the disposals dealers for a small sum.

In the main they appear to be designed to operate on 12-volts, although there are a fair sprinkling of 24-volt types. The immediate problem is that they require direct current.

We found that it is possible to

A REAR VIEW OF MODULATOR



A rear view of the modulator. The 6AU6 mic. amplifier is at the top left, followed by the 6SN7-GT driver, the driver transformer, output valves and modulator. Power transformer, rectifier and filter choke are along the rear edge.

COIL DATA FOR 807 TRANSMITTER

L1	17T 25 B & S, closewound on ¾in diam. former.
L2	9½T 25 B & S, closewound on ¾in diam. former.
L3	40T 25 B & S, closewound on ¾in diam. former. Tapped at 28T.
L4	13T 20 B & S, closewound on ¾in diam. former.
L5	4¾T 20 B & S, spaced ⅜in on ¾in diam. former. Coils L1 to L5 wound on ¾in diam. formers 2in long. L1 & L2 are wound on a single former 1in apart, similarly L4 and L5 ⅝in apart.
L6	3.5 Mc: 34T 20 B & S, closewound on 1½in diam. former. Centre tapped. 7.0 Mc: 24T 14 B & S, spaced 2in on 1½in diam. former. Centre tapped. 14.0 Mc: 15T 14 B & S, spaced 1¼in on 1½in diam. former. Centre tapped. 21.0 Mc: 11T 9 B & S, spaced 1¾in on 1½in diam. former. Centre tapped. 28.0 Mc: 9T B & S, spaced 1¾in on 1½in diam. Self supporting. Centre tapped.
L7	Adjust to provide loading of approx. 35 watts on 807 amplifier.
L8	Adjust similarly to L7. May require from 1 to 4 turns on 3.5 and 7.0 Mc, 1 to 3 turns on 14Mc and 1 or 2 turns on 21 and 28 Mc.
L9	3.5 Mc: 34T 20 B & S, closewound on 1½in diam. former. Tapped at 4, 8, 12, 16, 18, 20, 22, 26 and 30 turns. 7.0 Mc: 24T 14 B & S, spaced 2in on 1½in former. Tapped at 2, 4, 6, 8, 10, 12, 13, 14, 16, 18, 20 and 22 turns. 14.0 Mc: 15T 14 B & S, spaced 1¼in on 1½in diam. former. Tapped at 2, 4, 6, 7, 8, 10 and 12 turns. 21.0 Mc: 11T 9 B & S, spaced 1¾in on 1½in diam. former. Tapped at 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 turns. 28.0 Mc: 9T 9 B & S, 1½in diam. spaced 1¾in, self-supporting. Tapped at 1, 2, 3, 4, 4½, 5, 6, 7 and 8 turns.
L10	26T 14 or 16 B & S (preferably 14) closewound on 1½in diam. former. Tapped at 3, 6, 10, 14 and 18 turns.

DYNAMIC HEAD PHONES WITH MIKE

Suitable for short-wave enthusiasts. For No. 11, No. 22 sets, etc. In first-class condition.
Price, per set **19/6**
Packing and Postage: Vic. 4/6, N.S.W., S.A., Tas. 6/-, Q'land, W.A. 7/6.

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A beautiful and extremely accurate instrument, liquid damped, Adjustable reading prism complete with torch handle for standard battery; illuminates card for night use. Packed in transit carrying case. Easily worth three times the price

£7/10/-

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DASHBOARD PANEL MOUNTING COMPASSES

American made, liquid damped Compass with drum type dial, suitable mounting into dashboards. Face 3¼in dia., depth 4¼in.
Price **£3/10/-**
Postage and Packing: Vic. 4/6, N.S.W., S.A., Tas. 5/9, Q'land, W.A. 6/3.

BUILD YOUR OWN DUMPY LEVEL

The "ASTRO COMPASS" can, with slight modification, be made into an accurate dumpy level. Additional requirements a light tripod and telescopic sight. The instrument has declination scale with micrometer adjustment, azimuth circle, cross levels, adjustable turntable. Fully calibrated. A precision instrument.. Price **£2/19/6**
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MAKE YOUR OWN FISHING ROD

PRICE 15/-
Plus 5/- freight

With this Tank Whip Aerial the handyman can make a flexible fishing rod equal to the expensive type used by keen amateur fishermen. Comprising two 4ft tapered tubular sections of tempered spring steel, fitting snugly into each other, it is a simple matter to construct a first-class rod. Weight 6oz. .. *Despatched by quickest route.*

PRISMATIC TELESCOPIC SIGHT

Can be converted for use as rifle sight, surveyors' sighting telescope and many other uses where first-class lenses are required. Length 5½ ins. Eye-piece lens 1in, front lens ½in, eye relief 3in. Weight 15 ozs. Price **£3/10/-**
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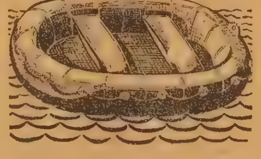
DINGHIES



Air-Sea Rescue Inflatable Dinghies. Size 10 ft. by 5 ft., with two cross seats. Ideal for the fisherman or for the beach.
Price **£15**
Freight forward.

BOMB HOISTS, Price £6/15/-

Light weight, portable, manually operated, overall weight 12lb. Reduction gearing 187-1. Triple lifting cable. Length of hoist 7ft. Lifting capacity ½ ton, but owing to high safety factor demanded for the work these hoists were used for it is considered the actual lifting capacity would be far greater than this.
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Packing 5/-. Freight Forward.

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Suitable for cars, trucks, or any dashboard panel. Made by Smith of England, these are ex-aircraft 8-day clocks with 2¼in face.
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For Light and Power Plants

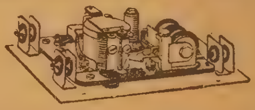
12v. 500w.	£5
12v. 500w. Brand new ..	£10
12v. 750w.	£10/-/-
24v. 500w.	£11/15/-
24v. 1000w.	£12/15/-
24v. 1500w.	£15/15/-
30v. 100 amp	£30/-/-

American-made Eclipse 24v. 1000w. brand new Cond £17/10/-
The 24v. models can be operated as 32v. without alteration.
Packing 5/-. Freight forward.
12v. Automatic Cut-Out suitable for above units 15/-
Packing and Postage: Vic. 3/6, N.S.W., S.A., Tas. 4/-, Q'land, W.A. 4/6.

50-0-50 Amp Meter, 2¼in dial, also to suit above equipment £2/10/-
Packing and Postage: Vic. 3/6, N.S.W., S.A., Tas. 4/-, Q'land, W.A. 4/6.

3½in V. Pulleys, splined to fit Generator Shaft £1/15/-
Packing and Postage: Vic. 3/6. N.S.W., S.A., Tas. 4/-, Q'land, W.A. 4/6.

REGULATOR & CUT-OUT



Suitable for use with above Generators with the exception of the American model, or as tractor spare. Made by Bendix of U.S.A.
Price **£4/19/6**
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COMPASS TYPE P.4.

A large navigational compass, 7 inches dia. x 3½ inches deep. Spring mounted with adjustable circle calibrated in degrees. This is a liquid-filled compass originally a pilot type, but can be used for all types of small sea craft.
ALL RECONDITIONED AS NEW.
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BENDIX LOOP AERIAL, RA 10 FA. Incorporating a rotating mechanism and reduction gear with a 9in loop.
Price **15/-**
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e up an excellent relay power
ply with a small power trans-
ner and a few disposals copper
le rectifiers. The power transfor-
is a standard line originally de-
ed for a battery trickle charger.
lelivers 17 volts at 0.5 amps.

he rectifiers are of the bridge type
originally came from telephone
els. As far as we can gather
are rated at up to 50 volts and
seem to be able to handle up
50 mA without undue tempera-
rise. In any case, they are not
ly to be in operation for extended
ods in amateur service.

AY POWER SUPPLY

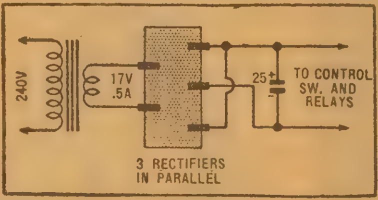
e connected three rectifiers in
allel so that the supply would be
py delivering anything up to
mA. With 450 mA load, inciden-
y, the output voltage is about 12.
he majority of the 12-volt relays
e a resistance of 100 ohms so
three such relays may be oper-
from the one power supply.

s you will note from the cir-
, we connected a 25 mfd, 40 volt
trolytic condenser across the out-
of the supply. During the stand-
periods this condenser charges to
peak output of the rectifiers,
ch is about 23 volts. The full
unt is momentarily applied to the
ys as the change from "receive"
transmit" is made, which ensures
the relays close with a healthy
p.

bout the only thing which re-
ns to be discussed is the matter
the key click filter. As you are
re, unless special precautions are
en, any transmitter will radiate
lick at the instant of closing the
and again at the instant of open-
the key. With high speed key-
this can add up to some pretty solid interference on adjacent channels.

It is simply due to the fact, that when the carrier is started or stopped suddenly, a transient is formed. The effect is similar to that encountered when an electric light is switched on or off.

The remedy is to slow up the rate of application of the full power to the transmitter and similarly provide some means of preventing the sudden break when the key is lifted. In our case the required characteristic is achieved by a small iron cored choke placed in the plate circuit of the power amplifier (this arrangement happens to be convenient for switching purposes) and an additional condenser in the cathode circuit.



The above is a suggested arrangement for a relay power supply. The rectifiers are a disposals bridge type and three are wired parallel in order to handle the current required to operate up to three 12-volt 100 ohm relays.

We found that the results were excellent with a choke having an inductance of approx 1 henry in the plate circuit, and a 2.0 mfd condenser in the cathode circuit. The values are the same as suggested for the 6BW6 transmitter since the ratio of the plate volts to plate current is not radically different in this case.

The condenser we used is a paper unit rated at 2.0 mfd and 200 volts. The choke was made by winding 1000 turns of 35 gauge B. and S. wire on the core of a small speaker transformer. The assembled laminations were 1½in x 1¾in x ½in thick. A cardboard bobbin, designed to fit over the ½in x ½in core was made up and the wire wound on with the aid of a hand drill. A layer of brown paper was placed between every few layers of turns to minimise the possibility of shorts.

You will find that the finished transmitter will deliver as clean a signal on the air as could possibly be wished for both on CW and phone. Its power input of 35 watts will be found to be an excellent compromise for many new amateurs whose interest in radio came too late for advantage to be taken of the cheap high power components which were available from disposals dealers after the war.

THE RECEIVER

For those who are interested, the receiver which was mounted in the rack when the photograph was taken is the "Short Wave Seven," described in the March, 1949, issue of Radio and Hobbies. Copies of the complete issue are no longer available, but we can supply the circuit and also a blueprint of the chassis through the query service for the usual charge.

While the "Short Wave Seven" is by no means representative of the latest in design for such a receiver it is capable of doing an excellent job and has the advantage that it is comparatively easy to construct. Possibly we will be able to describe a mode modern receiver along the same general lines at a later date.

KIT SETS!

NOW AVAILABLE FOR THE NICHOLLS SOUNDCRAFT MODEL II TAPE RECORDER DECK!

This complete Kit Set contains all the parts necessary to build a first-class mechanical deck.
All parts are precision built and prefitted.
Only the best materials used.

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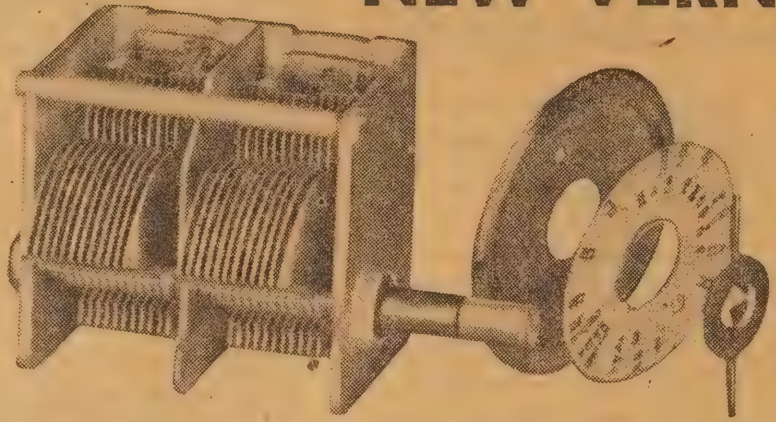
Announcing the **"ROBLAN"**
NEW VERNIER DRIVE



Standard and vernier Roblan gang condensers are now available with maximum capacity values of either 370 or 415 mmfd. (The latter tracks with "H-type" dials). All gangs are supplied complete with mounting feet.

370 mmfd gang has 12 rotor plates and the 415, 13 rotor plates. The new vernier drive is supplied as a complete tuning set including metal escutcheon, calibrated celluloid dial and pointer.

All units are inspected and passed by our test laboratory and are therefore guaranteed against faulty workmanship and material. Obtainable from leading wholesalers throughout Australia.

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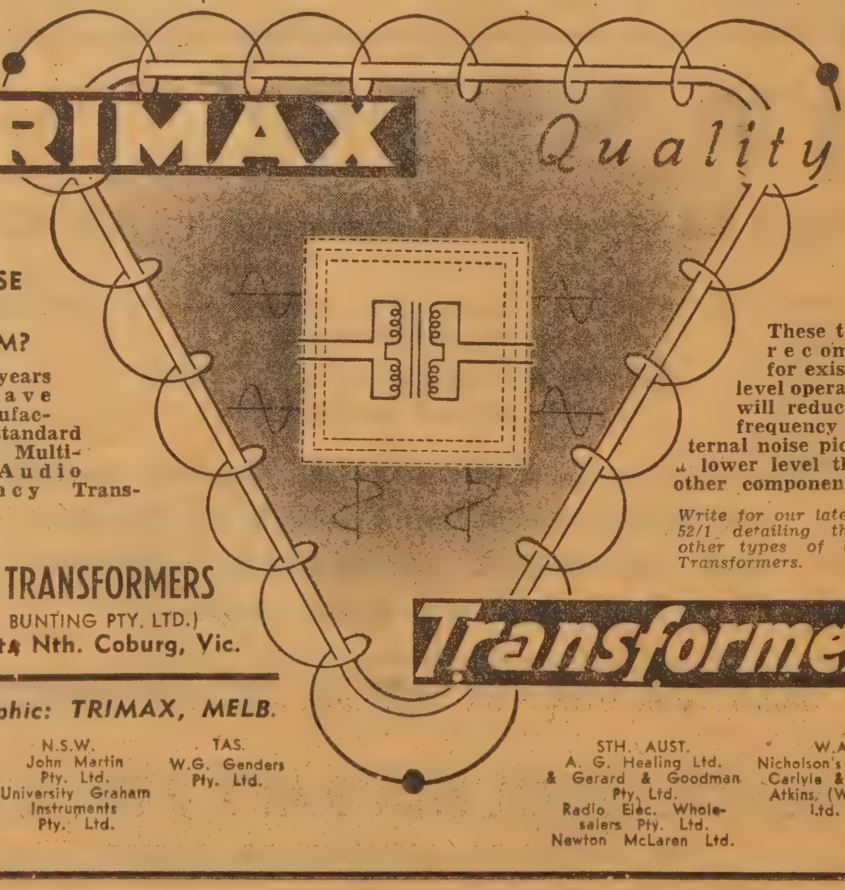

IS NOISE YOUR PROBLEM?

For many years Trimax have been manufacturing a standard range of Multi-shielded Audio Frequency Transformers.

These types are recommended for existing low level operation and will reduce power frequency and external noise pick-up to a lower level than any other component noise!

Write for our latest leaflet 52/1 detailing these and other types of low level Transformers.

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TESTING PLAYMASTER RECORDER

Making disc records which are substantially flat up to 10kc with a home recording head seems rather far fetched at first sight, but the result of the tests as detailed below indicate that it is possible by use of a variable negative feedback circuit, and an adequately powered amplifier. No longer need the home recordist make excuses for his records—they will stand comparison with the real thing. No critical components are involved

N our August issue we published an article describing how the laymaster No. 2 amplifier could be odified for use with a high imped- nce disc recorder (Byer R-12-D).

The feature of the amplifier was a rcuit by which the effective imped- nce of the output stage was made to se with frequency in an attempt to atch the recording head, which, of ourse, exhibits the same character- tic.

Nominally of 4000 ohms at 1 kc, he head reaches 10,000 ohms at a ttle over 3 kc., rising very steeply. emoving the feedback from the utput stage by a condenser would llow the output impedance to rise o a reasonably similar order, thus maintaining a much more constant urrent through the head than if it were to remain unaltered.

From past experience with this cir- uit, first used in the Junior Re- order of last year, we expected this method of coupling to make the best f the recording head's capabilities.

By using a 10 watt amplifier, and he extra power reserve it provided or a head which probably needs less han 1 watt, we were also able to use fairly high value of series resistor o improve further the conditions of matching, and even have something o support a degree of treble boost in he endeavor to hold up the extreme igh frequency response of the head.

VALUES OPTIMUM

A few hours recently spent pro- ucing "Xmas tree" patterns indi- ated that our values, &c., were just bout optimum, and allowed records o be cut which, near the outer edge f a 12-inch disc, at any rate, closely pproximate the standard micro- roove recording curve.

As the recording head itself is quite simple type, without the assistance f knife-edge bearings and other re- inements of design found in profes- ional heads, it was not anticipated hat results would be very good above bout 7-8 kc. In practice, they are very much better than that.

At the outside of a 12-inch disc, nd provided the level is not set too high, it is possible to get almost nor- mal microgroove pre-emphasis with one degree of treble boost from the control unit. Nearer the inside of the record, the response falls away after 3 kc., as might be expected, but it was something of a pleasant surprise to see the response holding up as far as 10 kc.

Using the 45 rpm speed, where we have the advantage of the extra stylus velocity, the pattern was even better, and the slope of the curve over the full band was very close to the ideal, with a slight bump around the 4 kc. mark not enough to really bother about.

It is probable that the response would continue quite usefully even higher than 10 kc, but as we were using a frequency record for the initial signal, we were limited in this instance to 10 kc.

The technique for these tests was to play from the record (using a high-grade pick-up almost flat over the full range) through the Control Unit, using full microgroove compensation so that the output was virtually constant from 50 cycles to 10 kc. This was then fed to the recorder unit cutting the disc.

The patterns were examined under a single point light in the normal manner, and then played back through the amplifier, using a CRO on the output of the control head to check the levels which came back off the record.

SLIGHT DROP

Some drop in actual output was observed as against that to be expected by inspection of the light pattern, but this may be due to the fact that it is easier to cut high frequencies on an acetate disc than to play them back. The material is much softer than that of a processed disc, and an accurate and new stylus point is really necessary for the best results.

Up to 8 kc., however, there was no trouble to get substantially level output even half-way through a 12-inch disc, which compares quite well with all but the very best commercial standards.

At a later date, we hope to make more precise tests, using an input signal from an audio generator, which will allow a larger range to be explored, and probably show an improved performance.

The waveform picked off the frequency disc was visually clean over the complete range, and very little distortion was evident from the acetate disc. Certainly there were no serious bumps or malformations to be seen, and the output sounded quite clean in the speaker.

Using the recorder on music instead of steady tone is a less drastic test, as the power involved in the higher frequencies is not nearly as great as lower down. Consequently, it is possible in practice to record without distortion at a higher level than is permissible when making a frequency run.

At the same time, the need for plenty of power to cope with the top end is a most important point.

Generalising for a moment, if we assume the current through the head is constant for the sake of discussion, the increase in power needed will be proportional to the increase in head impedance. This is 4000 ohms at 1 kc., but is likely to be 40,000 ohms or more at 10 kc., a ratio of at least 10-1 and calling for 10 watts if we assume we need 1 watt at 1 kc. Even this approximation is probably being too optimistic, and we haven't yet provided more power to cover the extra treble boost needed to give us what we want.

LARGER AMPLIFIER

For these reasons we are intending to make some experiments with a larger amplifier, using 807's just to see what can be done. At the moment there is reason to believe that a higher amplitude of cut can be made without high note loss by providing more power. The failure of the 10 kc. cut to rise as the level is increased is believed due to amplifier overload and not to the limitations of the circuit or the head.

Playing back records made at present show them to be bright right from the start. At the outer edge, extra treble cut sounds best over and above normal microgroove de-emphasis, indicating that theory and practice somehow work together! The difficulty is to get musical input with a wide enough response to allow us to adequately estimate the results we are getting.

POSSIBILITIES FOR TAPE RECORDING

THE technique of using variable feed-back to match the source impedance of the output valve to a recording head should be just as applicable to a tape recorder as it is to a cutting head. Essentially they are both current operated devices, and as such the problem of matching impedances at various frequencies is much the same.

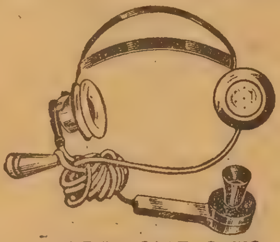
In fact it should be possible to use a Playmaster Junior amplifier using a single 6V6 output valve, in conjunction with a Control Unit No. 2 to make good tapes providing a high impedance recording head is used and, of course, a bias oscillator is added.

The advantage of the system, which so far we have not seen used elsewhere, is that it allows really good results without the need for any tuned circuits or critical components.

The release announced in this issue of a simple tape deck for use with any good gramophone motor as the drive unit gives added points to this Playmaster idea, which we are examining at the present moment. It works very well on playback, but so far we have not concluded some experimental work on recording. We hope to have some further comment to make at an early date.

JONES PLUGS AND SOCKETS

As illustrated. Available in following sizes, all brand new and in perfect condition.
6-pin 5/6, 8-pin 5/6, 12-pin 8/6.
Weight 8oz.

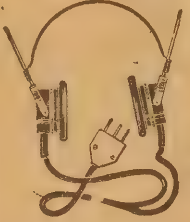


HEADPHONE SETS

Headphone and Microphone Sets. for high fidelity work, robust in construction, phones are equipped with velvet ear pads.

Price Complete, 15/-

Microphone only 8/6, Headphones only 10/6.
Weight 2½lb.

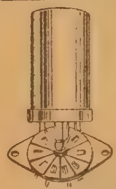


HIGH and LOW IMPEDANCE HEADPHONES

Made in Germany and brand new, these phones have 4,000 ohms impedance and can be adjusted in a few seconds for maximum output and efficiency. A locking arrangement will then hold them in this position indefinitely. Ideal for Crystal Sets small Valve Sets or any other purpose. This is the finest headphone we have had for years. Easily worth £4/10/-.

Our Price 39/6

Weight 1¼lb.



E.F. 50 ENGLISH LOCTAL VALVES NOW ONLY 15/-

Weight 5oz.

Low loss sockets to suit same 3/- each.
Weight 3oz.

NOTICE

All parcels sent registered post unless otherwise stated. Postage or freight must be included with order.

CONDENSERS

The following job condensers are mostly British made for the Admiralty and all are in perfect condition.

Capacity	Test Voltage	Working Voltage	Type	Price	Weight
.005 Med.		2500V	Block	2/- ea.	6oz
.02 ,,		300V (Mica)	,,	1/6 ,,	6oz
.02 ,,		8000V	Tubular	3/6 ,,	8oz
.03 ,,		5000V	,,	3/6 ,,	7oz
.1 ,,	800V		Block	1/3 ,,	3oz
.1 ,,	500V		Block L	1/- ,,	3oz
.1 ,,		4000V	,, ,,	4/6 ,,	13oz
.2 ,,		6000V	Oil filled	4/6	9lb
.25 ,,	1500V		Black (German)	1/6 ,,	3oz
.25 ,,	2000V		Black (German)	2/- ,,	4oz
.25 ,,		400V	Tubular	1/6 ,,	2oz
.25 ,,		2000V	Block	4/- ,,	6oz
.25 ,,	2500V		,,	2/6 ,,	9oz
.5 ,,		500V	,,	1/6 ,,	4oz
.5 ,,	1000V		,,	2/- ,,	5oz
.5 ,,	2000V		,,	2/- ,,	6oz
.5 ,,	8000V		Oil Filled	4/6 ,,	2lb 14oz
.5 plus					
.5 ,,		500V	Block	2/- ,,	5oz
1 ,,		500V	Block	2/- ,,	4oz
1 ,,	800V		,,	1/3 ,,	4oz
1 ,,		1500V	,,	5/9 ,,	12oz
1 plus 1		450V	,, L	3/- ,,	7oz
4 Med.		450V	,, L	2/- ,,	4oz
8.8.8 ,,		450V.	Tubular	3/- ,,	4oz
12 ,,	500V		Black	8/9 ,,	1lb 9oz
30 ,,		100V	,,	2/3 ,,	3oz
32 ,,		350V	Tubular	2/9 ,,	5oz
50 ,,		50V	,,	2/- ,,	2oz
80 ,,		100V		2/3 ,,	5oz
250 ,,		25V	Block	1/9 ,,	5oz
500 ,,		15V	Tubular	2/- ,,	5oz

★ SPECIALS ★

Resistors

Well known make of carbon resistors.

1 watt—250 ohm to 5 meg. Price **6d each or 4/6 doz.**

½watt—50 ohm to ½ meg. Price **4d each or 3/- doz.**

¼ watt—160 ohm to ½ meg. Price **3d each or 2/3 doz.**

Should we be out of stock of any value ordered we reserve the right to supply the nearest value we have left.

12in Speaker Baffles

Suitable for amplifier systems, radiograms.
1/6 each.
Weight 2½lb.

Clear Dial Glasses

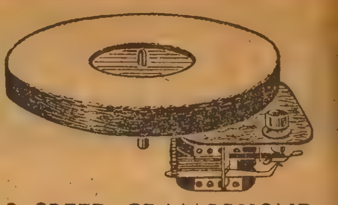
Size 9½in x 4⅝in.
Price 1/- each.

Rubber Covered Flex

Available in 200yd reels of 23/0076, suitable for 240 AC.
Extra value at 29/6 coil.
Weight 8lb.

4 Mil Plastic Tubing

50yd rolls black plastic tubing, usual price 19/6 roll.
Our price 12/6 roll.
Weight 1lb.



3 SPEED GRAMOPHONE MOTORS

Well known English make with heavy turntable, adjusting knob changes, motor speed to 33, 45, or 78 RPM. Ideal for new microgroove records.

Normal price £8/10/-.
Our Price £5/10/-
Weight 7lb.

English two-way crystal pick-ups to suit the above motors and they have a special plug in cartridge. Complete with both cartridges.

Normal price. £8/-/-
Our Price £5/7/6
Weight 1lb 4oz.

CATHODE RAY TUBES

Well known 5BP1. Now available for the astounding price of **9/11** each.

Sockets to suit 5BP1, **8/6 each.**
VRC 97 English 6 inch Cathode Ray Tubes. Price only **38/6.**
Weight 4½lb.

★ SPECIALS ★

4 Core Rubber Covered Cable

Overall length 7ft 6in. Suitable for Head and Breast Sets, extension speaker leads and many other odd uses. Worth 4/-.
Our price 1/- each.
Weight 8oz.

Job Line Sapphire Needles

British made will play 2000 records Trailer type, fit any standard pick-up. Worth 13/9.
Our price 7/9 each.

Well known Brand of Vibrator Transformers

Type ITJ-5318. Input 6 volts. Output 230 volts at 25 ma. Worth 35/-.
Our price 9/6.
Weight 4lb.

Job Speaker Windings

For following speakers, Jensen and Old Saxon, New Saxon, Midget Rola and Standard Rola. All are suitable for 6V6G, EL3, 42 and 6F6G Valves. Worth 8/-.
Our price 3/9 each.
Weight 4oz.

Stand Off Metal Spacers

Made of ¼ round tapped at both ends for ⅛in Whitworth screws, length 6½in.
Price 6d ea. or 4/6 doz.

6in English Speakers

Brand new and boxed. Worth 45/-.
Our price 29/6.
Weight 2½lb.

MOTOR SPARES LTD.

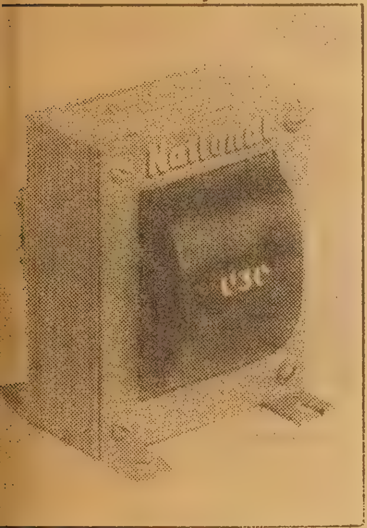
547 ELIZABETH ST., MELBOURNE

TRADE REVIEWS AND RELEASES

MIDGET POWER TRANSFORMER

ITENDED for miniature receivers and small items of test gear, new miniature power transformer eased by "National," measures 5-8in. high x 1¼ x 2¼.

Designated as type U30-150, it has 30-240 volt primary winding. The gh tension secondary is rated at 0-150 volts at 30 milliamps and e heater winding 6.3 volts and 1.7 nps.



It is normally supplied for veral mounting, the mounting feet ing integral with the lamination amping brackets. Finish is in grey amel.

Supplies of the new transformer ill be available through all "National" distributors. Trade inquiries ay be addressed direct to Wm. J. cLellan & Co. Pty. Ltd., 126 Susx St., Sydney.

ROBLAN GANG NEEDS NO DIAL

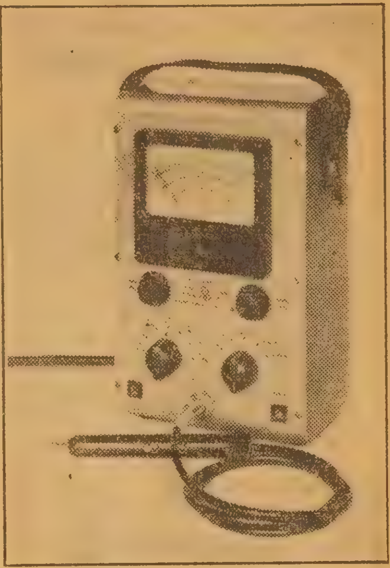
HE familiar Roblan miniature gang has now been made availle with an important addition—a duction drive built into the spindle. iving a speed reduction of just over 1, this drive makes it unnecessary small receivers to provide a sepate dial mechanism.

The condenser looks conventional most respects except that the indle is in two sections, one to rry the pointer and the other the ob.

This gang is supplied in 370 mfd. aximum capacitance, but the comany is planning to release also iniature gangs with a slightly gher maximum capacitance and ith a tracking law to suit the conentional "H" type dials.

AWA RELEASE "VOLTOHMYST"

A new A.W.A. addition to the test instrument field is the A.W.A. Voltohmyst. This instrument, which employs an electronic bridge circuit stabilised with negative feedback, is ruggedly built for use in the field of radio, television, electronics, and general industry.



ITS accuracy and stability also make it a useful adjunct to the equipment of electronic laboratories. It is suitable also for radio and television testing and the measurement of complex wave-form voltages in the laboratory, factory or service shop. The volthohmyst uses a 200-microampere movement with an accuracy of plus or minus 2 pc.

Some of the features of the instrument are:—

Seven non-skip ranges for resistance, voltage and current measurements.

Direct measurement of complex waves from 0.2 to 1400 volts, peak-to-peak.

Overall accuracy for DC measurements; plus or minus 3 pc of full scale.

Measures DC voltages and current from 0.02 to 1500 volts and millamperes.

Measures rms values of sine-wave voltages from 0.1 to 1200 volts.

Full-scale voltage points increase in a uniform three-to-one ratio.

Frequency response flat from 30 cs to approximately 2.5 mc—with crystal probe 50 kc to 250 mc.

Negative feedback circuit providing overall stability.

Fully enclosed metal case shields electronic bridge from RF fields. Conveniently portable.

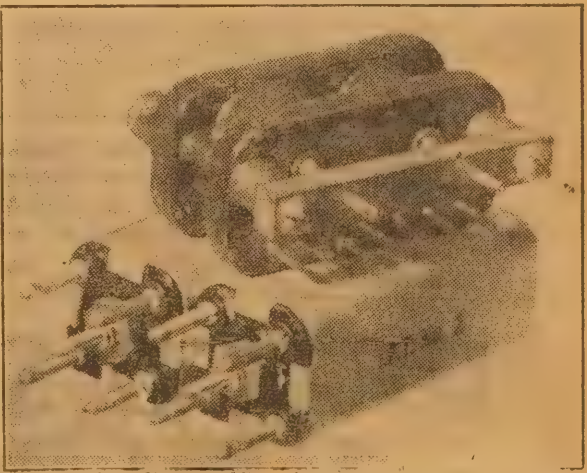
The piece is £45 with direct probe. An additional crystal probe is £6/6/- extra. Limited supplies are now available.

COILS FOR SMALL CAR RECEIVER

An interesting new coil kit has just been announced by the Aegis Mfg. Co. Pty. Ltd., of 208 Lt. Lonsdale St., Melbourne. It is intended especially for use in small-size car receivers having no RF stage ahead of the converter.

THE aerial and oscillator coils are mounted in a single assemly measuring 1¾ x 1¾ x 7-8in. The assembly automatically earths the two adjusting slugs and make the connections available on stout brass rods. The two IF transformers follow conventional miniature pattern, measuring ¾ x ¾ x 2 7-8in.

The kit, as shown above, is intended for use with the 6BE6 converter and an accompanying diagram shows the recommended connections.



The Aegis miniature coil kit is available to constructors through dstributors in all capital cities.

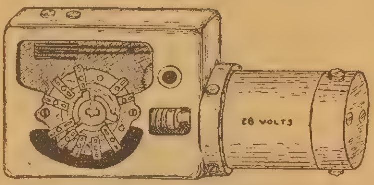
PRICE'S RADIO ***announce the purchase from***

EXCELAIR RADIO

OF THEIR ENTIRE DISPOSALS STOCK

The following are a few of the scarce components now available — watch R & H next month for further releases.

SWITCH MOTORS

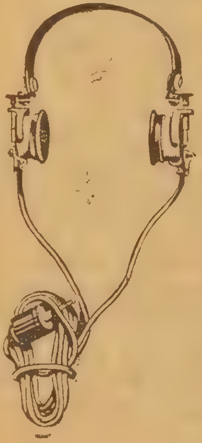


These units have been removed from MN26-C receivers and are in new condition. The motor, which is 2¼in long by 1½in diam., operates from 28 volts, DC, but could be rewound for lower voltages. 60:1 worm gear drives a 2-pole, 3-position wafer switch as well as a 2-pole jack-type switch. The motor is suitable for many purposes and is particularly suitable for driving an "O" gauge model locomotive.

37/6

Postage NSW 2/3, V., Q. & T. 3/8, WA & SA 5/-.

HEADPHONES



Army headphones are now very scarce. These are brand new headsets, complete with adjustable bands, cord and plug. Standard low resistance type only. 120 ohms per pair.

10/-

Postage NSW 1/10, V., Q. & T 3/-, SA & WA 3/9

GENEMOTORS

Midget "Command" genemotors. 28-volt input; 250 volts, 60 mA output. Size 4 5-8in x 2⅜in diam. As new.

27/6

Postage NSW 2/11, V., Q. & T. 4/4, SA & WA 6/-.

CARBON MICROPHONES

Respirator type with rubber mouthpiece. In perfect order.

5/-

Postage 1/3.

POCKET COMPASS

The ideal hikers' compass. Fitted in bakelite case 2½in v 2½in, with mirror in lid to enable readings to be made at eye level. Luminous scale for night use. Brand new.

29/6

Postage NSW 1/10, Q., V. & T. 3/-, SA & WA 3/9.

METERS

The following meters are brand new:

"Vane" 0-100 mA, DC. 2in diam., with mounting flange. . **30/-**

"British make" 0 0.5 amps RF (Thermocouple) 2in square case **17/6**

Packing and Postage 1/-.

G.U.D. SOLDER PASTE

The bargain of the year. 1lb tins of high-grade soldering paste. Enough for years for any amateur.

The prices quoted are for a 1lb tin of GUD paste and postage to your State.

NSW 2/10, V., Q. & T. 4/-, SA, WA & NT 4/4.

RELAYS

High-grade Relays as removed from IFF units. They are in perfect order. Overall sizes 3½in x 1½in x 1in. Coil 150 plus 150 ohms.

5/-

With 10,000 ohms coil.

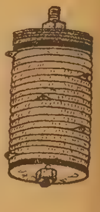
7/6

Postage 9d.

Jones 8 contact plugs & sockets	**3/6**
Cable plugs & sockets. 26 contact	**5/6**

Plus Postage

RECTIFIERS

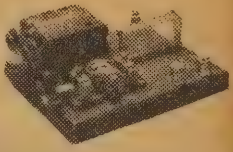


Brand new Copper Oxide Rectifiers, Bridge type 48 volts at 100 mA. This is the type specified for Radio and Hobbies TRICKLE CHARGER. Other applications are for operation of relays in radio equipment. Point motors or solenoids for model railways. They can be used singly for 100 mA or paralleled for higher currents.

4/6

Postage 9d.

MORSE SETS



These Morse Sets are soiled, but otherwise in perfect order. They consist of a plated key with solid contacts, special buzzer with double adjustment. Headphone jack, Battery and line terminals and battery strap. For operation from 3 volts.

5/-

Postage NSW 2/11, V., Q. & T. 4/4, SA & WA 6/-.

BUZZERS

Double adjustable high tone buzzers as used in the above Morse Sets. As well as being a buzzer, these units incorporate a microphone transformer.

3/6

Postage NSW 1/10, V., Q. & T. 3/-, SA & WA 3/9.

VALVES

The following valves are guaranteed in new condition, being removed from disposals equipment after a few hours' use.

6H6 6.3 volt Duo-diode.	**5/-**
6SH7 6.3 volt High gain RF Pentode	**5/-**
6K7 Metal replacement for 6U7	**7/6**
7193 6.3 volt UHF Triode . .	**5/-**
EF50 6.3 volt high gain RF Pentode	**10/-**

The following are brand new:

AV11 high voltage rectifiers for Cathode Ray Tube work . . .	**9/9**
954 Acorn RF Pentode . . .	**10/-**

Packing & Postage 9d.

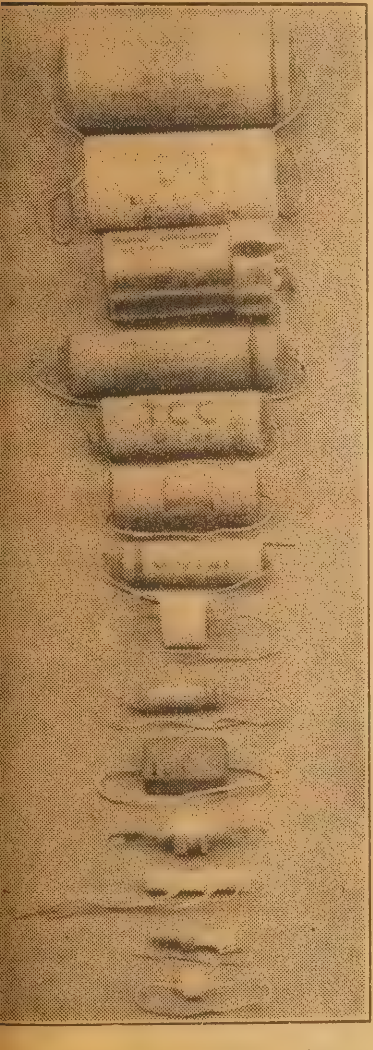
PRICE'S RADIO

5 - 6 Angel Place Sydney

JCC CONDENSERS ARE SMALLER

HE United Capacitor Co. are now applying the latest miniature anufacturing techniques to a large nge of their products, including per, electrolytic, and ceramic electric types. These techniques sult in a considerable reduction in ze for a given capacitance without ny reduction in voltage rating.

The accompanying picture gives me idea of the range available and.



o give some idea of the reduction hich has been achieved, two sizes re quoted: The popular 25 mfd. 40PV lectrolytic is only 1¾" long by 11/16" iameter, while a .1 mfd 350WV aper capacitor is 1½" long by 7/16" iameter.

Home constructors would be well dvised to aquaint themselves with ypes available, since many construcion articles are now based on the se of these midget types, making ossible very much more compact quipment than has previously been ossible.

Copies of the catalogue which was rinted on pages 55 to 58 inclusive f September Radio and Hobbies are vailable gratis upon application to he United Capacitor Co. Pty. Ltd., 33 Punchbowl Rd., Enfield.

TWO NEW FERGUSON PRODUCTS

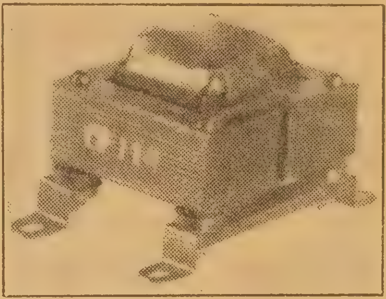
With an eye to the safety angle in garages and workshops, Ferguson Transformers have released a range of step-down transformers to operate 32-volt lead lights. Another interesting item is a rubber-mounted choke for fluorescent light fittings.

THE danger of using 240-volt lead lights in earthed situations is well known, many serious shocks having resulted from frayed leads and faulty fittings.

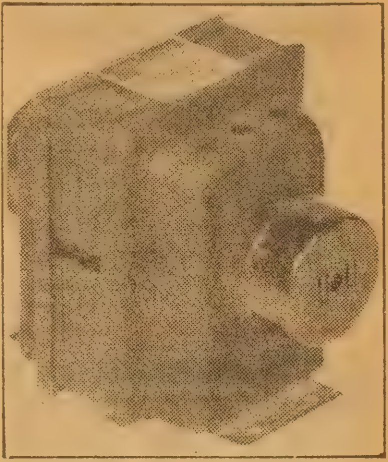
By inserting a step-down transformer and using 32-volt globes, the same amount of light is available but with no risk of shock in the event of damage to the lead.

Step-down transformers are available with ratings of 60, 125 and 200 watts, the retail prices being respectively £5/3/11, £8/5/2 and £10/18/3.

The transformers carry terminations for the regular 240-volt lead and a 2-pin plug for the outgoing 32-volt lead.



The new ballast choke, type CF114 is heavily impregnated to prevent direct lamination hum, the rubber mounting being an additional feature to absorb vibration between the choke as a whole and the fitting.



Supplies of both items are available through most radio and electrical supply houses. Trade enquiries direct to Messrs Ferguson Transformers Pty. Ltd., Ferguson Lane, Chatswood, NSW.

TRIMAX BOBBINS FOR EHT SUPPLIES

A RECENT release from the Trimax Company will be of special interest to intending constructors of radio frequency type EHT supplies.

Measuring two inches in diameter by 3 5-8 inches long, the bobbin has provision for a ten-pi HT winding as well as for the normal grid and plate windings of the oscillator tube. The die has been specially engineered to avoid rough edges, &c. in the slots where the interconnecting leads run from one section to the next.

The bobbin is moulded in heat-resisting, low-loss polystyrene, and can be used with windings delivering up to 50 KV maximum.

Retail price of the bobbin is 15/- and it is distributed in NSW by the Unversity Graham Instrument Co., 5 North York St., Sydney. Supplies can be obtained also through Trimax distributors in other States.

ERROR NOTE

IN the last issue, the diode load for the 6BV7 is shown in the wiring diagram as 0.1 meg. The correct value is 1.0 meg as per the circuit and parts list. Also in the turner circuit on page 43, pnis 3 and 4 on the 6H6 are interchanged.

RADIO ACCESSORIES

We specialise in Radio Parts and stock all reliable brands. We can supply: Coils, I.F.'s, Transformers, Resistors, Tubular Condensers, Valves, Wires, Flex, Meters, Testing Equipment, Radio Manuals, Irons, Toasters, Pressure Cookers, Jiff Toasting Irons, Trimmers, Padders, Gang Condensers, Motor and Pickups, Record Changers, Cabinets, Solder Irons, Solder and Electrical Accessories, 4 and 5 Valve Mantel Sets — Portable Sets, Console Radio and Radiograms, etc., Mantel, Console and Radiogram Cabinets. TECNICO Electric Lawn Mowers, Floor Polishers and Vacuum Cleaners.

2 and 3 speed Motors and Turntables

G.P.20 Pickups and Microgroove Heads.

DAVIS RADIO CO
Wholesale Radio Distributors
1st Floor Wembley House,
841 George St., Sydney.
Phone M3917
OPEN SATURDAY MORNINGS

SHORT-WAVE NOTES BY ART CUSHEN

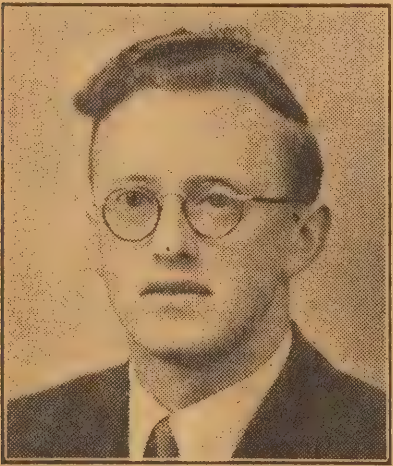
CONVERSION CHART

All times listed are Australian eastern time, and all frequencies are listed in kilocycles.

Metre Band	Megacycle Band	Kilocycles
49	6	6000-6200
41	7	7200-7300
31	9	9500-9700
25	11	11700-11900
19	15	15100-15350
16	17	17000-17850
13	21	21450-21750

NEW SHORT WAVE CORRESPONDENT

Our new Short Wave correspondent, Arthur Cushen, of Invercargill, New Zealand, needs little introduction to regular readers of Radio and Hobbies as he has been a contributor to these pages since the first issue.



Arthur won the World DX Contest in 1950 and 1951, is president of the New Zealand Radio DX League, an observer in New Zealand for the BBC, London. His DX reputation is world famed, he has over 2300 verifications made up of 906 on broadcast band, and 1455 on short wave.

Both Radio New Zealand and Radio Australia paid a tribute to Arthur in a recent interview when they broadcast details of his DX work and his prisoner of war monitoring activities to a worldwide audience.

The new International service of Radiodifusion National Belge, PO Box 26, Brussels, Belgium, with transmitters located outside Brussels at Wavre, commenced international broadcasts on August 1st. The Brussels station, using the call sign ORU "The Goodwill Station," absorbed the programs of the popular OTC Leopoldville, Belgium Congo station. OTC will act only as a relay of the ORU programs.

IT'S pleasing to note that many of the sessions made famous by OTC are being transmitted by ORU. This station thus has every chance of carrying on the good work of world friendship started by OTC which, listeners may remember was placed first in a world poll, to find the most popular short-wave station.

The frequencies assigned to ORU located at Wavre and using two 100kw. transmitters, are: 5970, 7170, 9665, 9745 9770, 11720, 11850, 11893, 15280, 15335, 17845 17860, 21510, 21715, 25630 25760 Kc.

OTC, Leopoldville, with one 50kw tra mitter, can operate on 6140, 7200, 97 9770, 11780, 15170, 17745, 21680, Kc., thou they have also been heard on 9665kc, frequency assigned to ORU, as we go press.

Schedule now in use, which we ha received via the International Sho Wave Club, London, lists only the bar they are to use, but we have includ the frequency also, when it has be heard here.

Schedule	Metre band/Frequency	Language
8.0. pm-midnight.	16	Dutch, 8.00-9.00 pm.
	19	French, 9.00-11.00 pm.
		French-Dutch, 11.00-midnight
3.00-5.00 am.	31 9745	For Missionaries, 3.00-4.00 am
	25 11850	Belgian Congo, 4.00-5.00 am.
5.00-6.00 am.	25 11850	English.
	31 9745	
6.00-7.30 am.	25, 31 11850-9745	French.
7.30-10.15 am	25, 31 11850-9745	Belgian Seamen.
10.30 am-3.00 pm.	31 9770, 9745, 9665 (OTC)	Portuguese.
		Spanish, 11.00 am-noon.
		French, noon-1.00 pm.
		English, 1.00-3.00 pm.

Reception conditions

October will be a month when we are at the crossroads in short-wave reception, daylight signals will be fading out and night signals with the band from 11 metres to 85 metres will be opening up, with good signals coming from European stations, in particular in the 19-metre band, and from South American signals in the 60-metre band. Listeners will find strong signals from Oslo (15170kcs) and Stockhom (15155kcs) at 9.0 pm, these with BBC transmitters, will provide the strongest signals on 19 metres, while, on 16 and 13 metre bands, Hilversum (17777 and 21480kcs) at 8 pm, Ankara (17830) is also broadcasting at 8.15 pm, with a program directed to Korea.

LATE TIPS

The Commercial Service of Radio Ceylon, Colombo, now operates 11.45 am-5.30 pm on 11975kcs, 7.15-9.15 pm on 9520kcs, 9.30 pm-3.0 am on 11975kcs. Latest Armed Forces Radio Service, for Los Angeles transmissions: KGEI-2 (11730), 2.0-3.30 pm; KGEI-2 (11730), 4.0-6.45 pm; KWID-1 (9570), 4.0 pm-12.15 am; KWID-2 (9570), 11.0 am-3.30 pm; KWID-2 (11860) 4.0 pm-12.15 am; KCBR-2 (17770), 11.15 am-4.0 pm; KCER-2 (9700), 4.30-12.15 am; KCBR-3 (15315), 11.15 am-4.0 pm; KCBR-3 (6040), 4.30 pm-12.15 am; KRCA-1 (9600), 11.0-4.0 pm.

DIGEST OF DX TIPS

Kcs.	Call and Location	Time Heard
4860	Srinigar, Kashmir	Sign off 3.00 am
5960	HJCF, Bogota, Columbia	Opens 9.10 pm
6110	BFEBS, Singapore	BBC news 9.00 pm
6115	Saigon, Vietnam	French program to 9.10 pm
9690	DZH5, Manila	News 8.15 pm under BFEBS
9770	ORU, Brussels, Belgium	News 2.50 pm
11795	Hamburg, Germany	German program 4 pm
11870	Moscow, USSR	English news 8.30 pm
11945	Djakarta, Java	Dance music 8 pm Sunday

NEWS FROM HOLLAN

Hilversum, Holland, the oldest sho wave broadcasting station in the wor known to the early listener as PCJJ a then PCJ, broadcasts programs direct to listeners in Australia each afterno at 12.30 pm in English and from 1.30 2.0 pm in Dutch.

This broadcast is directed to Nor America and South Pacific listeners, a is best received on 11730 and 9590kcs.

On Monday the transmission is r placed by the Eddy Startz "Hap Station" program. During the summ it is expected that Hilversum will r introduce the evening broadcast to Au tralia,, which is heard at 8 pm in t 16 and 13 metre bands. On Sundav 8.30 pm the programme broadcast is t Eddy Startz "Happy Station" show, which this announcer, one of the worl most versatile, speaking in seven la guages, broadcasts a very bright 9 minute feature.

NOTES for the November issue should reach Arthur Cushen, 212 Earn St., Invercargill, New Zealand, not later than October 9th.

The new Brussels station also carr broadcasts in Dutch, and these are sho on this page.

Radio Hollandia, Dutch New Guin operating on 7125kcs, has programs Dutch each evening from 7.15 to 9.30 p Radio Indonesia, in Djakarta, also h a transmission in Dutch from 4.00-5 am, directed to Holland and carried 11770kcs.

FLASHES FROM EVERYWHE

TURKEY: The experimental broadca of the Technical University of INstanb Turkey, are being received daily 7080kcs, from 4.30 to 6.00 am, using power of 500 watts. The station, loca in the Radio Lab., is operated by Electrical Engineering section, and bro casts Turkish and classical recor music. When closing at 6.0 am t have been heard with brief announ ments in English, thanking Jack Corb of Brisbane, and your Editor, for recept reports.

THE HAM BANDS WITH BILL MOORE

The Remembrance Day Contest is held annually on the weekend nearest to the anniversary of the cessation of hostilities in the last war. Teams from all divisions of the WIA compete for a trophy, on which is engraved the names and callsigns of all radio amateurs who made the supreme sacrifice.

HE contest run during August was ex- tremely well supported. According to ports and a check on the serial num- rs handled during the final stages of contest, some record scores should amassed. Quite a number of these res should be in the region of 100 nts and above, for a total number of tacts around 250.

Conditions over the 24 hours were ex- mely good on the 3.5, 7 and 14 Mc nd. The 21 Mc band was open for a mber of hours from the East Coast to stern Australia and New Guinea, but opening was recorded on 28 Mc.

CTIVITY IN VK9

ncreased activity was noted in VK9 l VK6. In the first mentioned district stations were heard operating.

n VK5 the number of stations partici- ing was reduced and some stations orted only 50 pc of the number of tacts with this State made last year.

eading stations in NSW should be 2AHA, VK2DO, VK2WH, VK2DG, 2AMR, VK2VN and VK2ANN.

B8ZZ on New Amsterdam Island, pro- ed some diversion when he appeared 14 Mc late on Saturday evening, and ne contestants stopped long enough to ister a new country.

here seems to be a possibility that the 9's could have won the coveted trophy. 9GW and VK9FN should record parti- arly good scores. The percentage of tions active out of the total number nsed should be high and this factor is most important one in deciding the imate winner.

he VK6 and VK7's were so well repre- ted that they are possible winners.

ARD FOR BIG STATES

he remarks made last year on the ject of the larger States winning the phy still stand, and the smaller States e a mortgage on it until the rules are ended. It is a teams' event, and the m of winning State division will have have worked hard to obtained the re- red points.

xactly one week after their previous ergency work on August 6 the Hunter nch net was again active. The Hunter River reached record levels causing serious flooding at both Singleton and Maitland. The net again handled river heights from municipal authorities in Singleton to flood headquarters in Maitland.

Bob Best, VK2TY, again acted as control station, and also active in the net were Joe Doran, VK2ANL, John Traill, VK2XQ, Keith Rudkin, VK2DG, Geoff Partridge, VK2VU, and Alec Mathers, VK2JZ. Operation continued for three days until the circuit was no longer required.

During the same period river levels rose rapidly on the North Coast. Fortunately the rain abated and serious flooding was avoided.

VULNERABLE POINT

North Coast amateurs were heard on the 80-metre band checking on the seriousness of the position and whether their services were likely to be required.

The most vulnerable point on the North Coast is at Kempsey where the Macleay River rises rapidly after heavy rains. Flooding did occur in the area, and Noel Hanson, VK2AHH, of West Kempsey, was operating, handling emergency reports for the Police Department. Noel operated on the amateur emergency frequency of 3501 Kcs and was in contact with the Newcastle police station VKG3 on 4560 Kcs. Messages were handled from the superintendent-in-charge of the area, giving accurate details of the position on the Macleay and northern rivers.

At times stations have been in doubt about the action to be taken before they can operate in an emergency. The conditions as set down by the PMG's Department have varied from time to time, and the following information was published in the April, 1952, issue of Amateur Radio, covering the latest requirements.

Emergency: Where amateurs are conducting emergency communications the following emergency signals will be used and adopted as a standard in VK.

For Telephony: The words "Emergency Traffic."

For CW: The letters QRRR.

Where life and property is endangered and no normal means of communication is available, amateurs are permitted to conduct traffic, using the above signals without prior consent of the department.

NEW FACILITIES FOR G. AMATEURS

ecently the GPO announced new faci- es available to British amateurs. They inly concern portable operation.

ermits are now available at a cost 10/- per annum for operation in the n air. As can be seen from the rules ering operation, the G's do not enjoy freedom of operation in the field ilable to amateurs here in Australia.

he following are some of the require- nts to be met by portable stations:—

peration is restricted to an area within miles of the location nominated in registration.

he permit authorises the licensee to rate on a boat, provided that it is ored or anchored within 100 yards the shore, or on a lake or on narrow nd waters.

or licensing purposes, narrow inland ters are defined as any canal or water- y which is not more than 100 yards le, or that part of a river between its rce and the point where it first be- nes 100 yards wide. A lake is any tch of water which has no outlet to sea, except by narrow inland waters which are at least five miles in length.

Use of a portable station will not be permitted from any vehicle or vessel in motion, within ¼ mile of any premises or vessel in which a receiver may be in use, or within one mile of any Government wireless station.

During portable operation the location of the station (identified by grid reference) or other readily decipherable means) and the callsign must be transmitting at least every 15 minutes.

When a portable station is established in a boat, it must be dismantled or otherwise disabled from sending if the vessel proceeds seawards of the defined limits as previously mentioned.

In view of the liberal conditions under which we operate, it is strange to read of such restrictions. The facilities as listed were, however, recently granted.

It would appear that G amateurs, if they decide to venture out around the water ways, will have to carry a theodolite and tape and become efficient topographers if they are to observe the letter of the regulations.

W.I.A. NEWS

President John Moyle, VK2JU, lectured at the August meeting of the NSW division on the various aspects of "Audio Amplifier Design." To illustrate the many points made, a full range of test equipment was on hand plus the necessary reproducing gear.

The number of questions asked at the conclusion of lecture showed the interest displayed, and the demonstration of the operation and checking of the performance by means of a CRO signal generator, &c., was greatly appreciated.

The business-period of the meeting was mainly devoted to a discussion of financial affairs of the division, and the council will report fully to the next general meeting on the position.

CIVIL DEFENCE

The NSW Division has decided to press forward with the initial arrangements for the forming of a civil defence net to cover Sydney and its environs. A committee comprising Wal Nye, VK2XU, as chairman, and Bob Winch, VK2OA, Chas. Fryar, VK2NP, John Miller, VK2ANF and Bert Beresford, VK2ABB, are working on the scheme to be run on 144 Mc.

Preparations for the 144 Mc Field Day, the combined effort of the NSW UHF section of the WIA and the Gladesville Radio Club are nearly complete. The event to be run over the three days of the 6-Hour Day weekend, October 4, 5, 6, will see extensive 144 Mc activity over many areas of the State.

Amongst the stations that will be active in field will be Keith Alcock, VK2AOA, at Canberra, Horry Lapthorne, VK2HL, Mt. Lambie, Blue Mountains, Bill MacGowan, VK2MQ, Mt. Gray, Goulburn, John Miller, VK2ANF, Mt. Canobolas, Orange, and Adrian Rofe, VK2HE, The Jib, Bowral.

All stations with 144 Mc equipment are requested to co-operate, main activity will be on Sunday, October 5, when all stations will be set up after long journeys to the sites.

WOY WOY FIELD DAY

The NSW division's premier field event will be held as usual at Woy Woy—the date, Sunday, November 16. Last year's attendance was 240. An increase is anticipated on this figure in view of the increasing popularity of the day.

Assembly as usual will be at the Masonic Hall, Woy Woy, at 11 am, and a full programme is being arranged for the day which will conclude at 5 pm. Special attention will be paid to the requirements of the XYL's and kiddies.

Wal Nye, VK2XU, and Cess Hardman, VK2KR, of Woy Woy, are working out the details and it is anticipated that some changes will be made. The 3.5 Mc transmitter search will be possibly eliminated, the 144 Mc search will certainly be made more difficult.

In the latter hunt, operators have become so proficient that transmitters were being located in a matter of minutes. This year's search will be much more difficult.

The scramble will be run at a different time to suit the programme. Don't forget to leave Sunday, November 16, clear for Woy Woy.

Full programme details will be given over the VK2WI Sunday morning broadcasts at 11 am.

The VK-ZL DX contest, as usual, will be conducted during October, and by that time DX conditions should have improved with the arrival of longer days.

The CW section of the contest will be run during the 24 hours from 1200 GMT

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The following details are quoted from a report issued by the National Physical Laboratory:

TOTAL HARMONIC DISTORTION for 10 WATTS OUTPUT
0.03 at 1000 c/s (0.0003 ratio to fundamental), 0.1 pc at 60 c/s (0.001 ratio to fundamental), with no more than 0.03 pc distortion over the complete frequency range.
HUM AND NOISE: —80 db, referred to 10 Watts.
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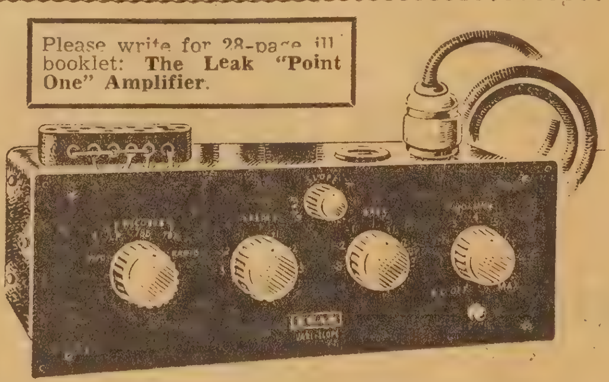
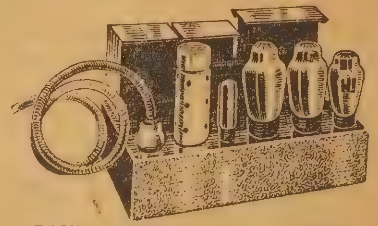


The new "VARI-SLOPE" Pre-Amplifier is a Radically New Pre-Amplifier for LEAK "POINT ONE" Power Amplifiers, embodying a Unique Feedback Circuit Development giving the user **Audibly Better Reproduction** from records and radio.



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This Amplifier can be supplied in either 12 or 25 watts models.

OUTPUT IMPEDANCE FOR BOTH MODELS: Output Transformer may be tapped at various stages over a range from 1.7-36 ohms.

VALVES: British valves are supplied with each Amplifier. Replacement stocks are available from Sole Distributor for Australia. All valves may be replaced **also with locally manufactured** equivalent valves.

RECORD REPRODUCTION: The equalisation for the recording characteristics of records is obtained in all three positions for "RECORDS" by resistor-capacitor feedback networks.
The "78B" position is very accurately the inverse of the E.M.I. characteristic. The Decca 78 characteristic is the same except that treble cut is called for above 4 Kc/s and the inverse can be accurately obtained by using the slope control.

PRE-AMPLIFIER

The "78A" position is for American records including LP's, for it very accurately follows the standard playback curve stipulated by The Audio Engineering Society, whose membership includes the foremost American recording engineers.
The "LP" position is very accurately the inverse of Decca, the new E.M.I 33 1-3 and 45 r.p.m. as well as for Columbia (U.S.) LP's.
The pre-amplifier will operate from any pickup generally available in the world. The sensitivity is 15 mV at 1000 c/s for full power output from the associated TL/12 amplifier. The input impedance is 100,000 ohms.

RADIO: The pre-amplifier will operate from any radio unit generally available in the world, the sensitivity being 60 mV. Flat response.

MICROPHONE: The sensitivity is 4 mV and the input impedance is 200,000 ohms. Flat response.

To people at present using the RC/PA/U Pre-amplifier, we can supply a special filter unit to be used in conjunction with the RC/PA/U, resulting in a performance identical to that of the VARI-SLOPE.

We thoroughly recommend for use with the above equipment, LEAK DYNAMIC PICK-UPS and CROSS-OVER UNITS with suitable speakers. For all further information contact . . .

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October 12.
lephony section: 24 hours from 1200
GMT Saturday, October 11, ,to 1200 hrs
' Sunday, October 12.
rial numbers will consist of six fig-
(five for telephony) made up of RST
rt plus three figures, which should
mence with 001 and increase by one
each successive QSO.
gs and summary sheets should be
'arded to the NZART, Box 489,,
ington, NZ, and the envelope should
narked VK-ZL Test.
tractive certificates will be awarded
vinners in each country and US and
and ZL districts.

NEW IDEA IN U.S.A.

e FCC have recently suggested an
'ely new departure in regulatory mat-

is proposed to set aside a segment
ach of the bands for calling and re-
ng—in other words, for CQ's and re-
to them. Stations after establishing
nunication would then change fre-
ncy outside the limits of the segment
continue their contact.
veral ideas are apparently behind the
osal. One would be ease of operation,
her to restrict superfluous calling and
imit unnecessary occupation of the
l.
lls, it is suggested, would be short,
s plus 4 callsigns and in reply 4 call-
s plus 4 callsigns. If no reply was
ived to a CQ call, a time interval of
minutes should elapse before further
calls are made. It would mean that
answer would be made to W CQ's
in the calling segment.

.OCATIONS

e suggested allocations for the pur-
are as follows: 1.7 Mc band, two
nents: 1800 to 1807 Kcs and 1993-2000
—3.5 Mc band, two segments; 3500 to
Kcs for CW and 3990 to 4000 Kcs for
hony—7 Mc band, two segments;
to 7105 Kcs for CW and 7290 to
Kcs for telephony. (This is within
limits of the proposed new telephony
ation)—14 Mc band, two segments,
) to 14050 Kcs for CW and 14220 to
) Kcs for telephony—21 Mc band, no
osals (sub-allocations CW and tele-
ny not fixed)—28 Mc band, one seg-
t, 29630 to 29650 Kcs. Segments are
listed for the UHF bands 50, 144 and
Mcs.
e above allocations can affect opera-
procedure in other countries. The
-3510 Kcs segment is the portion of
band most used by DX stations. It
ld be wise not to operate in W calling
nents on the DX bands, you might
be able to hear the W's at the time,
your signals at the DX station's
tions might be blotted out by them.
stations are generally more success-
in DX working by calling stations
er than CQ. If they don't like the idea
peration on the segments, the space
nt provide a good space for DX
ons outside the US.

ICALLY SOUND

sically the scheme seems sound, and
ld eliminate a lot of needless calling
restrict QRM. On a semi-local or
' band the idea is practical, but
ther it would work out on the DX
is is problematical.
Kcs is not much space for W's to
CQ and most of the low power sta-
s would be blotted out. They would
difficulty too, in picking out DX
ons from the jumble of locals. Any-
if you do make contact and decide
hange to X frequency, how do you
v it is not occupied? It is very likely
e if conditions are good
seems possible that no advantage
ld be gained in cutting operating time
CQ's and calls if you are going to
d time and power trying to locate
contact in a crowded band.

YOUR OPPORTUNITY

oin the world-wide ranks of amateur
smitters! The Wireless Institute of
ralia holds regular classes in Sydney
ssist Sydney and suburban enthusiasts
btain their Amateur Operators Certi-
es of Proficiency.
**e for particulars to the Class Man-
, W.I.A., Box 1734, G.P.O., Sydney.**

DX AND PERSONAL

NEW ZEALAND amateurs operating on the 80-metre band are not happy about the continuous carrier that runs on 3821 Kcs. Except for a rare announcement nothing is usually heard on the frequency. As the ZL's 80-metre band extends to 4000 Kcs, the station takes up a useful portion of the band. Some consternation was caused recently, when the ABC appeared on the frequency. NZ stations checked with VK amateurs but it was only their friend on 3821 Kcs with a B/c receiver running.

According to VK1PN on Heard Island, stations there have been monitoring the 50 Mc band and it is hoped around the summer DX period that some transmitting activity will be made.

NOVICE LICENCES

Novice licensing is proceeding at a fast rate in the US. 12,000 licences of this class were issued during the last 12 months. Each month the rate is rising and the previous figure could be doubled in the next 12 months.

The number of amateurs in the British Isles is rising each year and the 6500 mark was recently passed.

Well-known DX man Pat Miller, W2AIS, ex ZC6PM, is now signing W2AIS/KH6, and is in Hawaii with the FCC. Pat states that, despite the poor conditions for DX prevailing, KH6 is the best QTH he has operated from. Even 14 Mc is open through the night to Asia and Africa.

With the exception of a few stations, USSR amateurs are not permitted to work with stations outside the country. Regulations covering operating in the country include a classification of amateurs into three classes—novice, class 1 and class 2. Novices are allowed to 10 watts of CW on 1715 to 1800 Kcs and 3500 to 3600 Kcs. Class 2 operators may use up to 40 watts input CW on the two novice bands, as well as on 7000 to 7100 Kcs and 14000 to 14350 Kcs.

Class 3 operators may use CW or telephony on the aforementioned bands, plus 21,000 to 21,450 Kcs and 28,000 to 29,000 Kcs all with a maximum input of 200 watts.

In addition, all classes are permitted to use CW or telephony on their 85 to 87 Mc band.

A.O.C.P. CLASS

The Victorian Division A.O.C.P. Class will commence on Thursday, 30th October, 1952. Lectures are held on Monday and Thursday evenings from 8 to 10 p.m. Persons desirous of being enrolled should communicate with the Secretary, W.I.A., Victoria Division, 191 Queen Street, Melbourne (Phone FJ6997, from 10 a.m. to 4 p.m.), or the Class Manager on either of the above evenings.

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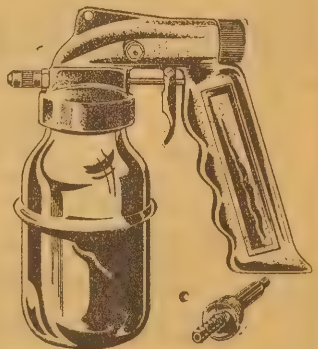

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OFF THE RECORD — NEWS & REVIEWS

Most of the answer about EMI's angle on micro-groove records seems to have been provided by the Earl's Court Radio Show lately held in London. On exhibition was equipment for playing these records indicating that both 45 and 33 speeds will be adopted, according to a report from a correspondent.

By JOHN MOYLE

AS I have frequently remarked in these columns, EMI has always seen that the 45 speed received plenty of mention in discussions or statements about microgroove. That's natural enough because of the company's connections with RCA Victor, which first announced this standard in America. And so I doubt whether anyone was really surprised to see a Hayes version of the RCA 45 rpm record-changer, which was actually produced many months ago. Its appearance confirms without any doubt that short numbers will soon make their appearance on the 7-inch discs.

The British price of the changer is £10 including tax. It will be a good deal more out here, if we can get it.

A second record-changer on show for £18 including tax was a standard 3-speed model.

It's pretty clear, therefore, that we can for the present time accept the view that there is no battle of the speeds any more, or at least that a truce has been called until things settle down in more ways than one. The standard gramophone motor for the time should be a 3-speed if the owner is to play all the records which are offering or will be offered.

In my opinion, however, it is only a truce. I think that, eventually, we will see a strong challenge from the 45 speed to supplant all others. It will succeed if manufacturers are able to make this speed play lo
enough. At the moment, it looks
though 33 has the edge in this regar
But it may not always be so.

I think the thing will come about
a natural process of elimination. T
appearance of the 45 rpm chang
leads one to believe that, although t
record companies say they will ma
78 records for a long time, th
would be very happy if they cou
wash their hands of this speed.
gives much less for the money th
with the other systems; it uses m
material records are much heav
and bulkier to handle. Very soon
will be of no value to any exce
owners of old acoustic machines
those who still cling to old-fashion
radiograms which must sooner
later wear out. I cannot see a
record company encouraging peop
to buy any more 78's. Conversel
they must therefore encourage the
to buy something else. That's why
always considered the 45 speed i
evitable, apart from any of its o
advantages.

33 AND 45 SIMILAR

It wouldn't be nearly so importa
to kill the 33 record as the 78. It h
much in common with the 45 reco
in the amount of material it uses (th
is, assuming a 12-inch LP 45 reco
which so far hasn't been seen).
uses the same type of pick-up, sty
point, groove diameter, and reco
stock. It is doubtful whether t
actual makers of the records wou
worry one way or the other. At t
worst, it merely involves a turntab
which will run at two speeds inste
of one, and that isn't hard.

So, for the time being, there it
It looks as though we can be prepar
for a period during which we will g
used to 45 and 33 records on a lar
scale. During the assimilating pr
cess, and the gradual improvement
the products which has been mo
marked since the first LP recor
were issued, the possibility of the
speed winning out will no dou
emerge. As long as our radiogra
will play both the new speeds, ho
ever, I don't think we need to
concerned about it for some time
come.

One or two other thoughts bef
leaving this subject. How long do
want a single side to play? T
longest major works, with one or t
exceptions, will not exceed 50 mi
utes, and the average is about
minutes. If we take 25 minutes p
side as being the optimum, and
are able to obtain equivalent pe
formance from either speed, then t
case for 33 records weakens. But
advances in technique allow us
achieve 25 minutes on 45 records.
is reasonable to assume that the
records will maintain their math
matical advantage and extend p
haps to 30 minutes. If this ext
sion is found to be valuable, then
33 record looks to be safe on t

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ınd alone. It's a matter which
›ably only experience can decide.
aving done away with the 78 re-
l, we have avoided the biggest
ance of the present moment —
need to change heads or styli
n going from 78 to 45-33. Because
e is no change needed for 45 and
we have another reason for some
fference in our choice between
n. If there must be a choice, then
nust win, because we can't make
ll records of good quality with
which therefore suffers a disad-
age when recording short, single
ical numbers.

es, I think we can prepare for
45-33 era lasting quite a while.
ne speed can win out, it will be
ınd not 33. At the moment, no
can say whether there will be a
ory, or an amicable peace treaty
long-term basis.

V PICK-UP

think I should make some refer-
here to a pickup which has
mentioned in Neville Williams'
ument" articles. So far we
printed some reports, views,
ns and counter-claims for their
interest value, and for the fun
all get from an argument.

mewhere between all these
gs there is, naturally enough,
man who makes the pickups, and
e know him, and have used his
up, I think it is only fair to give
ct or two.

the moment, I am not prepared
ivulge the name of the pickup
ıe maker, because, at present, he
roducing them on a hand-made
, and his output is ear-marked
ıis own clientele.

ıe pickup is a crystal type, in
h the same attention to reduc-
the mass of moving parts has
given, as in the case of high-
ity magnetic pickups. As a re-
the resonance peak has been
ed up well out of the audible
e in the case of the 78 heads.
own experience in building and
ilding pickups leads me to be-
that there should be little
ble in making a 78 head whose
onse would extend to the 20 kc
on, and with a fairly flat curve.
e is no inherent limitation of
rystal element which would pre-
this.

MMON PROBLEM

l pickup makers have found a
or problem in repeating this
ess with an LP head. Appar-
, there is something about the
rd material and geometry of
microgroove technique which re-
s the effective pickup resonance
nuch as 50 pc. The LP head
h I have tested on frequency
rds, therefore, showed a main
nance peak of about 11 kc. This
uch better than the average crys-
ickup performance, and among
best available. Distortion was
comparable with that from simi-
erforming pickups.

ıe general characteristics of a
tal pickup operating into a high
tance load shows a rising bass
a falling treble. As such, com-
ation would be roughly, the
shape as that required for
ogroove playing. When used
a much lower load of about
0 ohms, the pickup flattened out
the manner of a magnetic type.
1 78 records, using a .1 meg
as advised, the bass end would
fairly right, but the top would
ably show a gradual attenuation more than I personally, would permit. With a lower load, it would be flatter.

The reaction of anyone using such a pickup for the first time, if he has previously used a typical crystal with a big 5-6 kc peak, would be most marked. A big reduction in surface noise with 78 records would be certain, for there would be no serious peaks throughout the range to aggravate it. The falling top response would reduce scratch further.

On microgroove, some similar story would be told.

It is probable that the maker will be able to further improve his pickup and that future results will be even better. My reaction is that it is not a miracle pickup, as one might think, who has not used one of equal quality, but that it is a very good one, and much better in performance than the standard type of crystal which costs less, but is easier to make in quantity.

NO MIRACLE

I do not subscribe to the view that this or any other pickup would make 78 records sound just as good and as quiet as microgrooves of similar quality. Properly used, the pickup on microgrooves produced no surface noise at all, which is true of any other good pickup without a peak in the middle range. I have never used, nor am I likely to use, a pickup which had the same effect with 78 records, because here the problem is not one of pickups at all, but of matters inherent in the record itself. Mr. Williams has already given a clear and comprehensive analysis of this point.

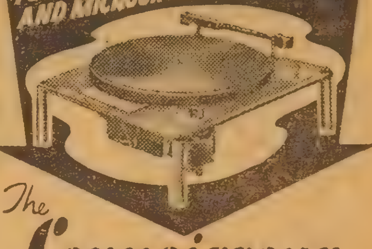
In short, this man has produced a hand-made pickup, which, as would be expected of any hand-made type, has improved characteristics not easy duplicated by mass production.

There is one point underlined by this little story, and that is the generally unsatisfactory position at the moment of pickups, particularly for microgroove. In my own case, I have solved it only by making one myself. Our ingenious and intelligent friend has solved it for himself and apparently for quite a few others, by a similar process. At the moment, I can't pretend to know the answer, but I hope that the probable acceptance by the average man of fair to medium reproduction using the present batch of pickups won't mean that we, who like the best, will continue to be in trouble.

MATTER OF POLICY

I'll say this, however, that anyone who is in a position to make really good pickups at a reasonable cost, which stand up to the claims made for them, will receive my unqualified support. This has always been the policy of this magazine, and in the past, we have been able to help more than one manufacturer who set out to supply a need, and to do it honestly and well. Unfortunately, it's not an easy job. There's not much future in trying to supply Australia with pickups or other components on a hand-made basis, particularly when so many insist on things such as automatic stops and record changers. We'd all probably give both such things away with a light heart, but to make things on a large scale for the biggest market, a manufacturer must consider these and many other similar problems.

Let's hope the shortage will be only temporary.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HOW TO MAKE LONG-RANGE LENS

A typical distant shot of cricket on the village green—a pleasing enough picture but useless if you happen to be interested in the players.

The type of picture you can get with a telephoto or a goo long-focus lens. Detail is much better than if you relied simpl on enlargement to give a "close-up."

While few readers may be able to afford a regular telephoto lens, some of the advantages to be gained from their use can be had by adapting a regular long-focus lens to fit the existing camera. This article from an English contributor outlines the essential features of the scheme for those who may like to try it.

BY G. F. RAYER

IT may be wondered what the advantage of a telephoto lens is and this perhaps should be explained first. Briefly, such a lens gives a bigger image on the camera film when snapping an object from the same distance.

The same is true with long-focus lenses, as shown on the next page. The increase in dimensions of the image is almost exactly proportional to the focal length of the lens.

For example, many popular cameras have a lens with a focal length of 7.5 cm. If a 15 cm. lens is used the image on the film will be twice as large in each direction. Likewise, if a 22.5 cm lens were used, the image would be three times as large in each direction, or occupy nine times the area.

ADVANTAGES

There is, of course, no need to keep to exact multiples, but a lens which gives an image two or three times the size of that obtained with the usual camera lens is convenient.

The advantage is clearly illustrated by the diagram where, with the short-focus lens, the building which is the centre of interest occupies only the centre portion of the negative. Tilting the camera can only have the effect of filling the rest of the negative with varying and unwanted amounts of foreground and sky.

With the long focus lens, the building occupies the whole area of the negative.

What this can mean in terms of actual photographs is illustrated by the pictures at the top of the page. They were taken on different occasions but the subject and distance from the camera are similar. In the one case the players are merely part of a general scene, in the other a group of them forms the entire picture.

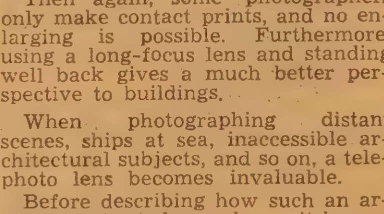
Lenses intermediate between the normal short-focus and the telephoto give proportions intermediate between these two extremes.

Some photographers possessing enlargers may feel that they could take the important part of the first photograph and enlarge it up to the same size as the second. But this is not so—in enlarging, detail is lost, because of grain, and much enlarging makes a very fuzzy picture.

Then again, some photographers only make contact prints, and no enlarging is possible. Furthermore, using a long-focus lens and standing well back gives a much better perspective to buildings.

When photographing distant scenes, ships at sea, inaccessible architectural subjects, and so on, a telephoto lens becomes invaluable.

Before describing how such an arrangement can be made up, it is perhaps wise to distinguish betwe long-focus and strictly teleph lenses.


Slot
Pin solid with inner tube
Thread to fit camera
Inner tube
Outer tube
Broken away to show how inner tube slips inside
Lens assembly
Threaded or soldered joint

A sectional view of the extension tube, showing essential constructional details.

The long-focus lens increases t size of the image, as already d scribed. Such lenses are easily o tainable from dealers. That used the attachment to be described be of 18 cm. focal length, with iris giving apertures from F6.8 F36.

The telephoto lens proper ho ever, consists of a long tube w three or more lenses arranged various points down it. This ty costs £25 upwards, and, as might expected, is specially designed for job.

SIMILAR RESULTS

It is the long-focus type wh is used here, and the effect is most exactly the same as the te photo.

The essential difference does lie in the amount of magnificati or that quality of the image, but the fact that the corners of the p ture may be cut off slightly by tubing employed. (This does arise in the telephoto because latter has a lens at the camera-e of the tube to spread the light r all over the film or plate). T longer the focal length of the l used, the more will corners of picture be cut off.

The 18 cm lens mentioned j cuts off the extreme corners amount being so small many peo would not notice it. Actually, t is not particular disadvantage.

Cheap box or folding cameras not very suitable for this type lens because they would have to permanently modified. Howev film and plate reflex cameras a plate cameras with viewing scre cusing are generally capable ption.

e will have the lens screwed flange.—It is, therefore, only ıry to unscrew the standard ıd screw in the long-focus lens will give the telephoto effect). rly, the original lens can be ɔd whenever necessary. Camvith permanently fixed lenses ısuitable.

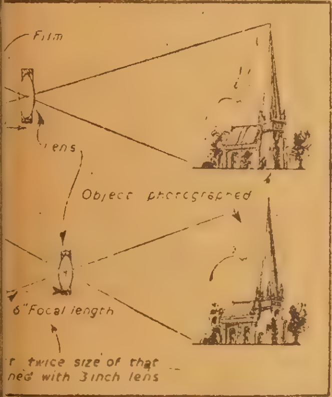
construction of the new as' is shown in Fig. 2. A tube ıired to screw into the flange, took the original lens. These métimes available from dealing known as extension tubes. ter tube slides over this tube, ıs a slot cut at an angle.

in or screw is driven into a hole drilled in the inner tube. the outer tube is rotated, it, ɔre moves backwards or forfor focusing. The tube illuswas made from clean tinrolled round a suitable obıd soldered. Brass, aluminium, er tubing would give a betish.

SOLDERED IN

long-focus lens was fitted pertly in the outer tube, being soldered at two or three The inside of the tube was arefully blackened to prevent ons.

length of the outer tube will l upon the exact items used. possible to measure from the ıot forgetting to include the



rating the effect of using lenses ifferent focal length. The choice nds on composition—how much of negative you wish the central object to occupy.

a itself. With the 18 cm. lens ı distance of 18 cm. was rebetween film and lens. This nade up by 7.5 cm. in the a, plus 1 cm. (approx.) for rewed tube, plus 9.5 cm. for ter tube.

ıe focal length is not known, the lens until a clear image s on the screen, then cut the o a suitable length. Particuactitude is not required, since ment can be made by the described.

ı reflex cameras and cameras a rear-focusing screen of l glass, the image will be seen s it will appear on the film, ın be focused sharply by turne outer tube of the assembly. picture can then be taken.

ı cameras not equipped with neans, a scale of distances can rked off opposite the pin. Dis-

(Continued on Page 99)

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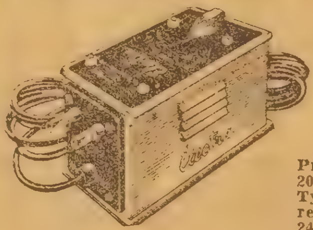

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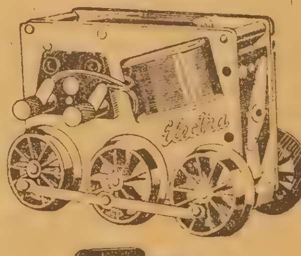

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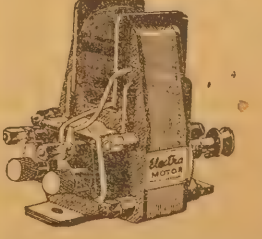

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16 EXPOSURES ON A 120 FILM

With the rising cost of film and processing, there is an obvious advantage to be had by i
creasing the number of exposures which can be made on a roll. While this normally involve
permanent modification to the camera, it is possible as a rule to avoid the necessity for thi

By W. HOUGHTON

IT would seem to be a straightforward job to convert a camera taking eight exposures on a 120 film to take 16 on the same film. Masking presents no difficulties, but the snag is making a new film inspection window in another part of the camera back.

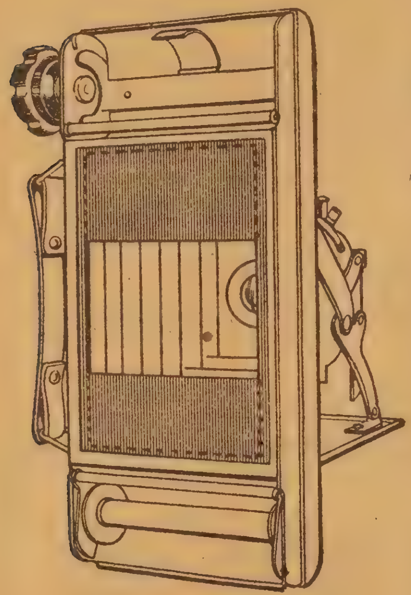

Fig. 1. — Sketch of a 3¼ x 2¼ folding camera with removable back detached, and showing the mask (shaded) in position.

A good camera has a first-class finish, and only if the workmanship of the modification is up to this standard would the job be satisfactory. Unless you possess a high degree of skill, to attempt to knock holes in the back of the camera to line up with the 16-exposure numbering on the backing paper is asking for trouble.

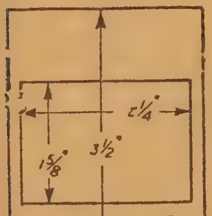

Fig. 2. — Details of the mask, cut from black card.

Sixteen exposures on a 120 film is quite a simple matter, without drastic camera modifications, by using the following method:

1. A mask of suitable black card or sheet metal is fixed in the camera. Selotape is suitable for this purpose. The 2¼in by 1 5-8in aperture should be cut accurately and the outside dimensions must fit the camera exactly. The mask must lay clear of the film, and in most Kodak cameras it can be fixed next to the bellows. (See Figs. 1 and 2).

2. The viewfinder must be suitably masked, and this may be achieved either by making a box-type mask to fit over the existing finder (Fig. 3A) or alternatively made from black paper and fixed inside the finder. The top can be removed quite easily in most types. (See Fig. 3B).

The box type of mask is made from thin card covered with black passe-partout. It has a one-position opening and has to be placed over the finder to suit vertical or horizontal "takes."

The size of the mask is worked out in proportion to the size of the existing mask on the finder, and remember that the camera must be held upright for horizontal shots and turned on to its side for vertical ones.

3. The film is rewound on to another spool so that "No. 1" is now the last and not the first to appear.

4. The loose end of the film is fastened to the backing paper with selotape. The trailing edge becomes the leading edge, and less fastened to the backing it will not find its way ar the take-up spool.

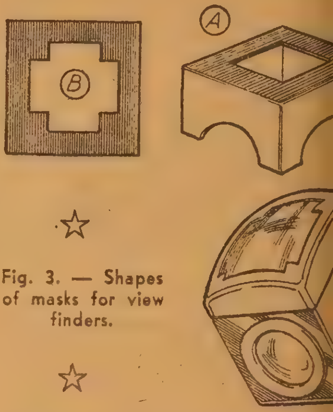

Fig. 3. — Shapes of masks for view finders.

Films prepared in this way i dark-room can be daylight l in the usual manner. The bering for 16 exposures will appear in the existing windov eight exposures, and although i appear backwards—16, 15, 14, this is no disadvantage. The portant thing is that you can make 16 exposures instead of

THE "WIDE BAND" SIX RECEIVER

(Continued from page 59)

wiring to the first two gang sections so that the residual capacitance between the "hot" ends of these two circuits is at a minimum.

The home-made capacitor for the 4 pf "top" coupling for these coils is provided by tightly twisting together two lengths of 7/.010 PVC insulated hook-up wire for a distance of 2in, leaving the two leads at one end spread sufficiently to reach across between the grid pins of the two aerial coils. Double the twisted length back on itself and bind it with cellotape.

The lettering of the switch sections in the circuit diagram was arranged to suit a convenient wiring arrangement. The sections are lettered in sequence in a clockwise direction looking at the lugs of the switch. Rotate the switch so the sections S1a and S1b are farthest from the chassis.

Of the two leads to the tone control, the one which connects to the .1 mfd capacitor should be in shielded hook-up wire to avoid any audio instability when passing over the connections to the volume control.

The 2500 ohm feedback resistor from the output transformer voice coil winding can be mounted on the spare lugs of the 4-pin miniature output socket. The selection of the rect side of the voice coil wi for connection of the feedbac sistor can be found only by and error. You will soon know you first switch the set on wh you have it wired to the correct When on the wrong side, a high audio howl will be set up.

SHIELDED WIRE

The connection from the pi terminals to pin 1 of the s ECC35 should be made in sh hook-up wire. Insulate both minals, connecting the inner w one and the outer braid to the Earth the braid at or near the to which the inner lead con Slip some spaghetti covering the braid to prevent it earthi the chassis at other than the point.

The final job is to mount the mers on the top of the gang se See that the top leaf of the tri is the one which connects t gang frame.

The alignment procedure f coil kit and the adjustment 10 Kc whistle filter coil has covered at length in both the A and September, 1952, issues of and Hobbies.

R. & H. JUNIOR SIGNAL TRACER

(Continued from Page 35)

r, it would probably be due to a
ted trimmer or aerial terminal
ting to chassis.

ext check point is the plate of
converter, where the signal
ngth should be considerably
ter. However, there is a point
atch here. Because the tracer is
tuned, it is possible to hear
als even if the local oscillator is
working, since both RF and IF
als are present in the converter
e.

CILLATOR GRID

counter to this limitation is the
that the local oscillator can be
ked in most cases by simply
ing the probe on the oscillator
when a rushing sound will be
d in the tracer if all is well.

ne probe is now moved to the
of the IF valve and it is quite
nal to find that the level is lower
, due to the losses in the IF
sformer and the fact that they
not provide a step-up ratio. No
signals will reach this far so a
oscillator failure could show
n this test.

the plate of the IF valve signals
be very strong and it may not
be necessary to make contact
his point, it being quite normal
pick up signals about half an
from the plate lead. In the
ndary circuit, i.e., at the detector
e, there will again be some re-
ion, though it may still be pos-
to pick up useful signals with-
actual contact.

ne audio probe will also pick up
als from this point, assuming that
detector circuit is functioning,
the level will be roughly the
e. From here on the audio probe
ld be used, the next check point
g the other end of the second-
winding which is really a meas-
nent across the diode load
als will be somewhat stronger
but will be weaker again at the
of the audio valve if the volume
rol is left in its normal operating
tion.

NALS FOLLOWED

om here on the signals will
w a logical pattern and may be
ed, if necessary, right through to
speaker voice coil.

the case of intermittents the
set-up appears to be one where
RF probe connects to the plate
he converter, the audio probe to
plate of the audio stage or the
of the power valve, and a meter
ss the self bias resistor of the
stage or between cathode and
sis where backbias is used.

ne controls should now be ad-
d so that equal volume is ob-
ed from the tracer, when switch-
either probe, and the set itself.
reading on the meter should
be noted and the set allowed to
until a "fade" occurs. If, when
happens, the signal from both
es and the meter reading are
anged, the fault lies between the
probe and the speaker and it
robable that the suspect area
be narrowed still further by
ng the probe in this direction.

the signals from the RF probe
the meter reading are unchanged
he signals from the audio probe are down the fault lies between the AVC pick-up point (usually the 2nd IF primary) and the audio probe.

When signals from the audio probe drop and the meter reading increases, but signals from the RF probe increase, it indicates that the fault is between the coverter plate and the AVC pick-up point, the increase in signal at the converter plate being due to the absence of AVC voltage. Finally, a drop in strength from both probes will mean that fault is between the aerial and the converter plate.

Regardless of which section appears to be at fault, it should be possible to move the appropriate probe in the direction indicated, thus reducing the possible number of components still further.

The above, of course, is necessarily only a brief description of what can be done with this instrument and a few brief experiments on one or two sets will be worth pages of description and we feel sure that, once you have tried this instrument, you will vote it one of the most valuable you have ever used.

LONG-RANGE LENS

(Continued from Page 97)

tances of 20ft, 30ft, 40ft, 50ft, 100ft, and "infinity" are suggested.

Positions for the markings can be found by taking the film from the camera and substituting a piece of ground glass, fixed, undeveloped plate, or thin paper. The lens is then focused on various objects at suitable distances and settings marked for future reference.

It should be noted that the focal length given for lenses is usually for objects at infinity (e.g.—far in the distance). To photograph near objects the lens will have to be moved away from the film. The camera should therefore be tried out of doors before the lens is finally fixed in the tube.

If not, it may afterwards be found that the tube is too long to permit distant objects to be brought into focus.

Exposures will be just as for the short-focus lens originally used, that is, about 1-100th second at F8 during sunny, summer weather, increasing to 1-50th during weak sunshine, and 1-25th for bright, winter days, with an average 30deg Sch. speed film. With poorer light, use longer exposures of larger apertures.

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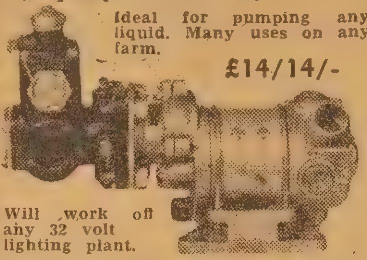

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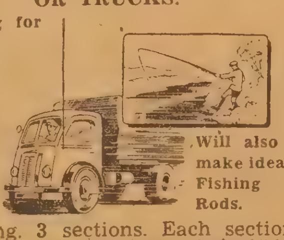

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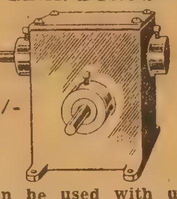

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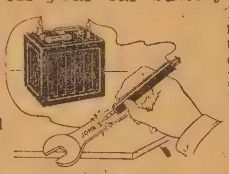

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29/6

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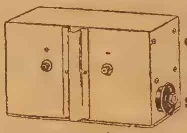
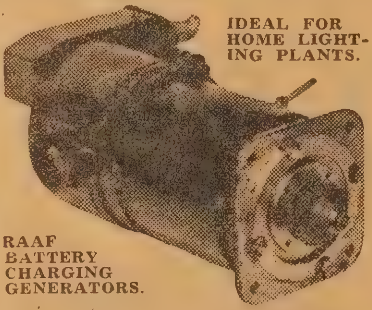
COMPLETE BATTERY CHARGER

Fitted with brand new English Selenium Rectifier.



Work off 230v. AC Household Supply.

Charges any battery from 2 to 6 volts at 5 amps. £6/15/-, complete.

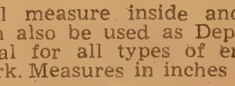


IDEAL FOR HOME LIGHTING PLANTS.

RAAF BATTERY CHARGING GENERATORS.

12-volt, 500 watt, in Good Working order	£5
12-volt, 500-watt, as new	£10/10/-
24-volt, 1000-watt, Brand New,	£12/10/-

BRAND NEW VERNIER CALLIPERS



22/6

Will measure inside and outside. Can also be used as Depth Gauge. Ideal for all types of engineering work. Measures in inches and m/m.

ENGLISH MOTOR AND BLOWER, 24 VOLTS

39/6

Will Work off 32-volt Lighting Plants.

Larger size also available that will work off 12 or 24 volts, £3/15/-.

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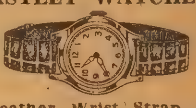
512 ELIZABETH ST., MELBOURNE, C.1.
PHONE: FJ5904. Just 4 doors fr

Mail Orders Carefully Packe
PLEASE ADD FREIGHT OR POSTAGE

How is this for Value:

GENUINE SWISS GENTS' WRISTLET WATCHES

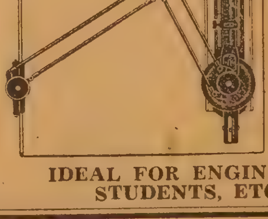


Genuine Leather Wrist Strap, 79/6.
Expanding Chrome Band, Ameri
Style, £4/4/-.

SPECIAL OFFERS

English 230 volt A.C. Relays, 50
Genuine English R.A.F. Flying H
mets, **35/-**. Speaking Tubes to
helmets, **50/-**. R.A.F. MK8 Goggl
48/6 pr. English 4 Draw Ri
Range Telescopes, 22 magnificat
17¼in long when extended. Wo
derful value, **£6/19/6.**
Swiss Music Box Units can
fitted into any type of box. Ma
yourself a music box. Tunes ava
able; Whistle While You Wo
Home Sweet Home; Happy Bir
day To You; When Irish Eyes A
Smiling; Forever and Ever, 30
Medical Scalpels, many us
photographers, etc., **6/6.** Twist D
Sets 1/16in to 3/16in, 9 Drills
6/9; 1-16in to 7/32in, 7 drills
6/9. Shaded Pole Induction Mot
made by Hoover of England,
volts, A.C. Ideal for project
Tape Recorders, Fans, etc., **£4/19**
Ball and Socket inspection Mirr
Ideal for Mechanics or Ra
work, **8/6.** Tapped Transform
6, 12, 18 and 24 volts, 5 amps, 39
230 volts input.
American Heavy Duty 10in Di
ders, **10/6.** American Rad
Gauges, **9/6.** 4in Callipers, ins
and outside, **5/6.** Full len
Men's Oil Skin Coats. Ideal
all outdoor work, **35/-**. Ameri
Alemite Grease Guns. Suit
modern cars, **32/6.** Army Ca
Stretchers, folding legs, canvas
55/-. English Low Pressure Sp
Guns, work off 35lb press
£3/15/-.
Imported Stock and Die Sets,
¾in, & in water pipe sizes, £5/1
Sport Binoculars, wonderful va
55/- pair.

R.A.F. PLOTTING BOARD WITH ARM



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IDEAL FOR ENGINEERS, STUDENTS, ETC.

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Efficiently Despatched
INCLUDE STATE IN ADDRESS

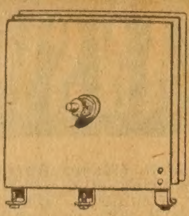
ENGLISH POCKET COMPASS

Brand New. Very accurate. No hiker should be without one. 6/9

BRAND NEW ENGLISH RECTIFIERS

Make yourself a Battery Charger.

12v. 2 amp 35/-
6v. 5 amp 45/-
12v. 5 amp 72/-
6v. 2 amp 24/6
12v. 3 amp 45/-
6v. 4 amp 39/6.



Transformers to suit above Rectifiers, 2 amp, 37/6. 6 volt 5 amp, 45/-. 12 volt 5 amp, 57/6.

MERICAN FUEL PUMPS

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R.A.F.
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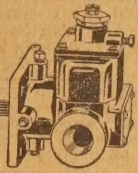

WILL PUMP ANY LIQUID

galls per hour. In excellent
, 55/-. Brand new, 75/-.

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ner Sets, open end, SAE or
. Special price, 5 spanners, 4/9.
or Whit, open end Spanners. 6
ners to set. German made,
set.. American Feeler Gauges,
English King Dick Ring Span-
1 1/16in x 1 1/8in Ring Span-
35/-, 1 1/16 x 1¼, 37/6.

amite Flexible hose-type
se Guns. Suit all modern cars,
Parabolic Reflector Mirrors,
15/-; 10½in, 39/6. Build your-
Spotlight or useful for photo-
ic work.
. Tube Spanners. Sets 3 Span-
and Bar, 11/9 set. 12in Steel
s, single-side, 3/6. 12in steel
s, double side, 4/6. 6in Steel
s, 2/6, 2-foot Folding Steel
s, 5/6. 1-foot Folding Steel
s, complete in leather carry-
ouch, 5/6. English Headlamps,
and Chrome finish, 6 or 12
Complete with Globes, £6/15/-
Whitworth Socket Sets, 6
ts and lever bar, 13/6 set.
worth Spanner Sets open one
ing the other, 25/- set, 6 span-
to a set. English Hair Clip-
first-grade quality, 17/6 pr.
ican Boxwood Yard Sticks.
for Tailors, Draughtsmen,
Brand new, 8/6. 6 volt
screen wipers worth £6/10/-,
al Price £3/15/-. Brand new
Steel Tow Ropes with looped
17/6. Army Tripods. Many
for photographic work, levels,
41in long, 22/6 each.

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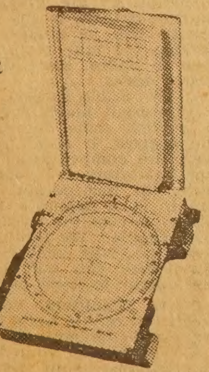
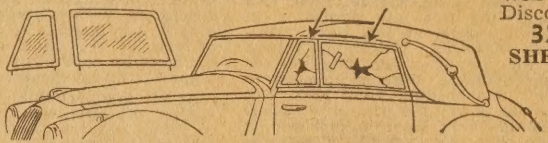
45/-



NOW YOU CAN REPLACE THOSE BROKEN SIDE CURTAINS WITH CELLULOSE ACETATE SHEETS.

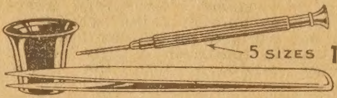
Takes the place of celluloid. Lasts 4 times longer.



Will not Discolor. 32/6 SHEET.

Non-inflammable cellulose sheets are recommended for making all types of side curtains, are 1/20th of 1in thick and sheets are 24in x 52in. Can be sewn or cemented into frames.

WATCHMAKERS AND INSTRUMENT MAKERS



14/9

English Tweezers .. .. .. 6/6 and 5/6
English Pin Vises 7/6
Eyeglasses . 6/6 and 8/6
Extra strong double lens Eyeglass 15/-
Small Screwdrivers, 2/6. Large, 3/6

BRAND NEW AIR COMPRESSOR

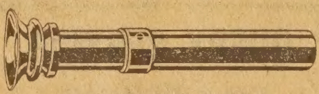
2.2 cubic feet, will pump up to 75lb

Never before at this price. Ideal for Spraying.

£11/15/-
Will work off ¼hp Motor.

ARMY FOCUSING TELESCOPE

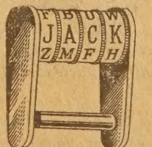
Easily converted for use on dumpy levels.
Can be used as a rifle sight.
Excellent magnification. £4/19/6
(Fitted with cross hair.)



ADJUSTABLE FOCUS

THE LATEST NOVELTY COMBINATION PADLOCKS.

No Key Required



Many Combinations available

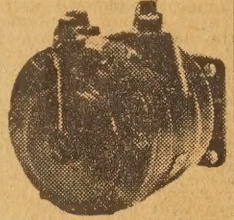
Ideal for Push Bikes, Lockers, Trunks, etc.
5/- each.

ENGLISH ARMY SPOTLIGHTS

IDEAL FOR SHOOTING. FIT ONE TO YOUR CAR.

6-volt, 37/6. 12-volt, 25/-.
Fitted with Mirror Reflector.

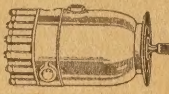
AMERICAN VACUUM or AIR PUMP



Builds up air pressure to 30lb at 1000 R.P.M. Develops up to 120lb of hydraulic pressure, will pump 7½ gallons S.A.E. oil or filter other liquids per minute. Useful for spraying, milking, presses, oil burners, hydraulic systems .. £3/15/-.

HYDRAULIC PUMPS, EXTRA LARGE

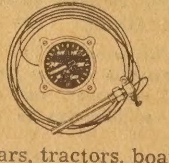
1200lb per sq. in.



8 1/3 gal. per minute.

Ideal for all Hydraulic uses.
Cost £100. OUR PRICE, £18/18/-.
Also 1½ gals at 1000lb per sq. in £7/10/-
3 Stage Hydraulic Pumps, 1200lb pressure 5 gals per minute, £10/10/-.

BRAND NEW REMOTE CONTROL TEMPERATURE GAUGES.



37/6

Ideal for cars, tractors, boats, ovens, etc. Never before at this price.

BRAND NEW AMERICAN THROAT MICROPHONES

IDEAL FOR FITTING TO GUITARS, VIOLINS, & SIMILAR MUSICAL INSTRUMENTS.

Lots of Fun!

10/6

AS USED BY THE R.A.F.

ANSWERS TO CORRESPONDENTS

J.McR. (Wagga Wagga, NSW) writes an interesting letter which deals with a number of subjects. His main concern, however, is with connecting a 120X speaker to an amplifier.

A. It is very difficult to construct a voice coil top-cut filter to work at an impendance of 2 ohms because of the large values of the condensers required. However, another approach to the problem is to include an auto transformer, or transformers, to step the impedance up to some convenient value, say 15 ohms. An article suggesting this was published in the September issue, as you have probably already observed. Unless you intend operating the amplifier for long periods at very high volume there is no need to worry about overloading your 120X. Six watts of audio power fed into an efficient speaker sounds very loud indeed and is much more than you are likely to need in any domestic application. A short peak up to 10 or 12 watts would not damage the speaker provided it is properly baffled so that the amplitude of the cone movement is not grossly excessive. If you do intend operating the amplifier at near output continuously, say in a large auditorium you would normally provide a special heavy duty speaker or a number of speakers placed so as to distribute the power in a favorable manner. We have no information on the crystal pickup referred to by the correspondent other than that mentioned in the letter. Sorry, but we do not have a list of frequencies used by various aircraft and marine services. The query you suggest for the Answer Tom page has already been dealt with but possibly we will include it again at a later date. Our series of articles by the Serviceman Who Tells is intended to help people interested in trouble shooting. We agree that to become proficient a good deal of practical experience is necessary.

G.R. (Singapore, Malaya) encloses a cutting from an American newspaper which deals with the possibility of long distance communication using the moon as a reflecting medium.

A. Many thanks for your letter, G.R. It is very interesting to read of the popular American approach to the subject. However, as this matter was dealt with in Radio & Hobbies some time ago we do not think that the material in the article would be of any great immediate interest to our readers.

W.J.F. (Huskisson, NSW) asks if there is any objection to constructing a Playmaster control unit and tuner on the same chassis.

A. None at all. Simply take the usual precautions with regard to layout that apply in all such cases and the combined unit should operate just as well as did the original separate units. The vital point is to keep the control unit off the chassis which houses the power supply.

D.I.F. (East Malvern, Vic.) would like some information on using the Playmaster amplifiers with a tape deck. He also asks if it is possible to achieve the results of one of the high quality twin cone speakers by combining a 12in speaker and a number of 3in speakers.

A. We are particularly interested in the subject of tape recording at the moment so that you can rest assured that we will be publishing some further information on the subject in the next few months. Certain 3in speakers have a poorer response at the extreme high frequencies than do ordinary 12in speakers, so that there would be little point in wiring them as you suggest. We have heard reports of good results with small speakers as tweeters after special treatments such as hardening the cones with lacquer but we have no definite information. Another limitation is their lack of sensitivity compared with the larger speakers.

J.H. (Wagga Wagga, NSW) wonders about obtaining some parts to build a crystal set.

A. There are several firms who specialise in mail orders for small quantities of parts. We suggest that you look through the adveritsements in this issue. Possibly you will be interested in the crystal set described in last month's issue. You should be able to get reception from 2WG from your location.

R.F.H. (Artarmon, NSW) writes to tell us of the enjoyment he gets from Radio & Hobbies, particularly the Let's Buy An Argument and Serviceman Who Tells series. For the latter he forwards details of a case of Morse interference which he recently investigated, and fixed, and which he considers might be of interest.

A. Thanks for your comments R.F.H., and we hope the magazine will continue to provide so much interest. The case of the Morse interference, which is certainly an interesting one, has been passed on to the serviceman for possible co ment at a later date.

E.A.C. (Blakehurst, NSW) proposes build the Fireside Five and wishes to a 385 volt power transformer in place the original 285 volt type. He also m tions having recently built the vibra unit for the Multi Talkie with v successful results.

A. Very glad to hear of your succ with the vibrator unit E.A.C., and also t you have found the magazine so help in the past. The transformer you h could be used by connecting a dropp resistor betwen the rectifier filament the junction of the first filter conden and the choke. A value of about ohms would be required in this case would dissipate approximately 8 wa When mounted under a chassis a 20 w rating would be preferred.

J.V. (Sydney, NSW) compliments us the quality of articles in Radio & Hobb and inquires about the possible use tape recorders as an aid to langu study.

A. We hope the present series eventually produce constructional det for a tape recorder. As these artic proceed you will be in a position to dec whether the material you have on h would be suitable for such a project. M tape recorders would be suitable for scheme you have in mind since it possible to erase any portion of the cording without difficulty, the only quirement being some mechanical me of knowing just what portion is to erased and to prevent encroaching on part you want to preserve.

J.I. (Mosgiel, Otago, NZ) forwards opinion on the publication of an ampli handbook and encloses details of amplifier which he has found to be v satisfactory.

A. Thanks for your favorable comme re the proposed publication of an plifier handbook, J.I. We are fi your amplifier circuit in the Reader B It file in case we can use it later in section of the magazine.

L.G.W. (Yandira, Qld.) asks a num of questions about radio.

A. Your questions are of such a nat that it would be difficult to ans them satisfactorily in these colun However, we will take the first opp tunity to deal with them in the Ans Tom feature.

L.C.W. (Ravenshoe, Qld.) comm favorably on the value of the Learn W You Build series of articles which published in the magazine from March, 1951 issue to July, 1952 issue asks whether the series is to be lished in booklet form.

A. We appreciate that the series moted wide-spread response, L.C.W., the question of publishing the serie booklet form has been under considera However, at the present time, we are able to make any definite statement the matter. We thank you for letter and wish you the best of luck your present course.

D.J.B. (Nambour, Qld.) expresses his preciation of the Playmaster series inquires if there is any chance that circuits will be modified to make suitable for tape recording. He is keen to obtain some details of tape corder decks.

A. The whole subject of tape recor is at present under review and we to publish some details along the you suggest, if at all practicable. ever, the compensating requirements tape recording are such that it ma better to incorporate this part of circuit in a separate unit, rather modify any of the existing amplifier this purpose. We think if you follow series on tape recording for the few issues you will find they pr the answer to most of your problem

C.C.H. (Caulfield, Vic.) writes his preciation of the Let's Buy An Argu series and comments on hearing aid de

A. Thanks for your letter and fo observations about less expensive Yes; we're still in the editorial chai the amateurs say, "Hi!").

THE "RADIO & HOBBIES" QUERY SERVICE

ALL queries concerning "R & H," designs, to which a POSTAL REPLY is required, must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three "R & H" constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis will now be 3/6. These are available for nearly all our designs.

Address your letters to The Technical Editor, "RADIO and HOBBIES," Box 2728C, GPO, Sydney.

Note that "RADIO & HOBBIES" does not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.

ı. **(Parramatta, NSW)** is anxious
a Signal Tracer described in Radio
bies.
e are planning to go ahead im-
ely with a couple of articles on
Tracers. As a matter of interest.
oject was treated in some detail
July, August and September, 1943,
of Radio & Hobbies. We are very
note your interest in the other
& Hobbies test instruments.

(Bendigo, Vic.) makes some in-
about a speaker horn described
'uly, 1952, issue of Radio & Hobbies
s mentioned in the issue, these
gs were reprinted from an over-
ournal as a subject of general
and we have not had an op-
ty to try the scheme for our-
It would appear that the top of
oinet is left open and that the
ıown in the drawing is only a
on line. It would also appear
back of the speaker is completely
d. If a second speaker is to be
e would suggest that it be housed
eparate cabinet, which is usually
fficult since high note speakers
no special baffle system. No
twin speaker sets are at present
le in Australia and the best you
lo would be to use two standard
s—say a 12in and 8in.

(Djakarta, Indonesia) comments on
cuit in the Reader Built It page of
& Hobbies for June, 1952, and
s a variation which is very popular
ope.
ıanks for your comments and cir-
S., and we have passed this on
Reader Built It section for possible
tion. The advent of the 6BV7
nay assist the popularity of such
nce it consists of a high gain
pentode and a pair of diodes in
e envelope.

. **(Dubbo, NSW)** forwards a sub-
n for a further 12 months of
ınd Hobbies and expresses his ap-
on of the previous issues with
ar emphasis on those containing
ıymaster series.
any thanks for your subscription,
which has been forwarded to
ropriate department. We are also
to hear that you enjoyed the
s 12 months' issues so much and
ou are getting such good results
our present equipment. As you
, a shield of some sort may
e hum problem, though it may be
ry to conduct some experiments
blish if the switch is really the
f the trouble. Your remarks about
mplifier Handbook have also
oted and we will keep your sug-
s in mind.

K. **(Burwood, Vic.)** writes to tell us
the success and pleasure he has
d from the All Band TRF described
o & Hobbies for September, 1948
any thanks for your letter G.A.K
are very pleased to hear of your
with this circuit. The stations
ve logged would certainly suggest
u are getting the best results from
atively simple circuit and also em-
the point that elaborate gear,
a help, is not essential for work of
nd. We sincerely hope you have
n success with your new project.

(Coogee, NSW) intends to build a
d version of the Playmaster No. 5
quires if the suggested alterations
be satisfactory.
ıe maximum plate to cathode volt-
the 2A3 valves is 300 and since 62
s required for bias a total HT
of 360 would be about correct
er, if you are planning a HT volt-
360 after allowing for the genera-
bias the valves would be operat-
ove their maximum ratings. All
considered we would suggest that
ginal circuit would be more satis-
and it might be better to obtain
transformer or, if the present one
ned, to arrange that total HT does
eed 360 volts. About the only way
ss the efficiency of your trans-
with the equipment you have is
sure the power output from the
er, using a resistive load shunted
the transformer primary and with
ondary open, calculating the power
ne AC voltage and the load re-
. The power may then be measur-
ss a resistive load of correct value
he secondary winding and the two
compared. We have no response
on the speaker you mention and
cannot help you in this matter.

(Canberra, ACT) requests the cir-
an elaborate radiogram which can also be used with a microphone for public address work.

A: W do not have any one circuit which would meet your requirements but if you care to write to us through the 2/- query service we will be able to send you the circuits of an amplifier and a tuner which, with some modifications, could be combined to do the job you have in mind. Sorry, but we can't possibly draw up special circuits for individual readers.

R.J.B. (Kogarah, NSW) is interested in an overload protection device which is installed in a commercial multimeter. He wonders if he could obtain one to install in a multimeter which he has on hand.

A: The overload protecting device you mention is an integral part of the particular multimeter and it would be difficult to install it in another instrument. At the very least several major changes in the values of shunt resistors would be necessary. The firm in question may or may not be willing to supply the device separately if you are prepared to make the changes. The best we can suggest is that you write to them.

R.P. (Urbenville, NSW) writes to tell us that he has successfully completed the Jubilee Portable. He reports excellent interstate reception at night on the loop aerial alone

A: Many thanks for your letter, R.P. We are very pleased to note that the set is working so well and also that you like the Radio and Hobbies in general. We have noted your suggestion re the article on using cathode ray oscilloscopes. We have noted your remarks about the kit of components.

J.O.R. (Kensington, NSW) who has recently come to Australia from Britain writes to tell us what he thinks is wrong with radio in this country.

A. The extensive use of plastic radio cabinets in Australia is not a matter of chance. Plastic cabinets are not only cheaper to produce in large quantities but are better able to withstand widely varying conditions of temperature and humidity encountered in this country. Moreover, people like them. At the same time quite a few table model sets are made with wooden cabinets. Many of our commercial receivers include several shortwave bands and some have the tuning mechanism arranged for bandspread. We have described several such receivers in Radio and Hobbies but, by and large, the local interest in shortwave listening is on the decline. The position with regard to broadcasting is considerably more favorable in this country than it is Europe largely by reason of the fact that we have no high powered foreign broadcastinig stations within short distances of our capital cities. Our national broadcast stations do not drastically limit the highest frequencies transmitted, except perhaps on 78rpm records. For those who are interested, high fidelity programs broadcast on VHF are available in some capital cities through FM stations operating on 90 mc. Some receivers are available to receive these stations. The authorities in this country have deferred the introduction of television. We can therefore reap the benefits of experience of other countries. Britain is now tied to an outdated 405 line system. The American 525 line system is better but we in Australia are in a position to improve on both. It appears that when we do have television it will be a 625 line system, possibly with color available to those who wish to build suitable receivers. We cannot agree with your remarks with regard to the relative entertainment value of radio programs, recording, and television programs. They are three completely different fields of entertainment and therefore cannot be compared on a common basis. While people are interested in music they will listen to good amplifierism despite other equipment are not decreasing in England and only just gaining impetus in USA attractions. The sales of special audio where television is most advanced.

N.G. (Marrickville, NSW) forwards a contribution for the "Reader Built It" page.

A. Thanks, N.G. We have filed the circuit for more detailed perusal in respect of possible publication in the "Reader Built It" section. Coupling through the interelectrode capacitances between the anodes of the twin triode was apparently the reason why you found it necessary to insert a volume control at the grid of the voltage amplifier.

N.H.V.
KITS

THE "TENNER"

10 Watt Amplifier
Kit £10
(Plus Sales Tax)

★ PHONO INPUT
★ MIKE INPUT
★ TONE CONTROL

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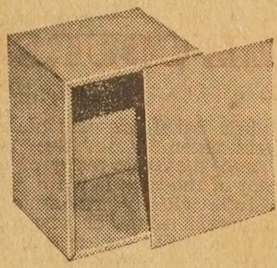

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THE COURSE IN TELEVISION

(Continued from Page 63)

substitute a flat fluorescent plate and wire grid assembly for the normal screen and masking plate of RCA. The front of the tube is plain glass.

One tube closely resembles the RCA approach in other respects, in that it uses three separate electron guns arranged side by side and aimed through a common focusing and deflection system.

The three beams converge on the wire grill and pass through it in discreet directions to excite respectively phosphor strips glowing in the primary colors of red, green and blue.

The wire grid has an accelerating action, as well as elongating the spot vertically so that it excites only the desired phosphor strip.

The disadvantage of this type of tube, as compared with the RCA tube, is that colors are fixed along vertical lines so that there can be no possibility of color displacement from line to line.

A very large number of fine wires would have to be provided in the grid with a correspondingly large number of phosphor lines to avoid loss of definition.

In the single-gun version of the Lawrence tube, the viewing screen carries 400 narrow green phosphor strips, each about .0135in in width. Between the strips are alternate red and blue phosphors, as shown. These are so arranged that there are 200 red and 200 blue phosphor strips, each double the width of the green strips.

The grid structure involves two sets of wires insulated from each other and accurately registered so that the wires are exactly in a line between the gun and the phosphor strip pattern on the viewing plate.

Separate external connections are provided to the grid structures so that different deflection voltages can be applied to each.

When the voltages on the two structures are balanced, the beam pases directly between the wires to strike the green phosphor.

Differing voltages on the grids deflects the beam slightly to the right or left so that it excites the red or blue phosphors, as required by the picture. It is simply a matter of correct modulation of the beam and correct synchronising to build up a complete color image in any required fashion.

Thus, to build up a CBS frame sequential picture, one grid structure would be held more positive than normal for 1/144th second to produce a complete red frame. The two grids would then be equalised for another 1/144th second to produce green and then unbalanced the other way for the same time period to produce blue.

By way of interest, the Lawrence tubes employ a specially designed gun to produce good initial focus with relatively low accelerating voltages—up to about 4000 volts. This simplifies the initial deflection requirements and also ensures that the color control grid system can likewise provide suitable deflection so close to the screen.

However, the grid structure itself operates with a mean DC potential around 10,000 volts, ensuring a rapid final acceleration of the beam with a consequently bright picture.

This tube, too, has been criticised on the score that it does not provide sufficient color definition bu
makers claim that it is en
feasible to increase substantiall
number of wires in the def
grids and the corresponding nu
of color lines on the phosphor.

One thing is certain, namel
all these tubes are still due
great deal more developmen
although they indicate possib
and trends, the manufacturer
have to learn from experien
methods which best lend them
to mass production.